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# Europe/Latin America Report

SCIENCE AND TECHNOLOGY

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23 MARCH 1987

## EUROPE/LATIN AMERICA REPORT

## SCIENCE AND TECHNOLOGY

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## EAST EUROPE

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## WEST EUROPE/BIOTECHNOLOGY

### PROGRESS REPORT ON THREE FRG GENETIC RESEARCH CENTERS

Bonn BMFT JOURNAL in German Dec 86 p 11

[Text] Program funding of biotechnology is having an effect on the scientific and technical progress of the FRG. The concentration of funds on centers where university, industry and scientific organizations are cooperating in biotechnology and gene-technology research, has proven to be a successful guideline of R&D policy to reinforce basic, biomedical research and basic scientific research.

The number of scientific employees has reached more than 300 at the three gene centers in Cologne, Heidelberg and Munich. The expansion phase of the centers is generally concluded. The annual funding by the Federal Ministry for Research and Technology (BMFT) is about DM18 million. Industry provides DM3 million annually. In addition, the particular State governments also contribute.

Of the large number of interesting research projects at the three gene centers, we mention the successful work at the "Center for Molecular Biology, Heidelberg" (ZMBH) for fighting the hepatitis-B virus. They succeeded in using genetic engineering to obtain a vaccine. The vaccine will evidently be the first of its kind which can be used on a very large scale and open up the way for a world-wide fight against the hepatitis-B disease.

The establishment of new companies is also being promoted. The program of the Federal Government "Applied Biology and Biotechnology" provides about DM100 million for the indirect, specific funding of biotechnology product development. By 1 September 1986, 14 approvals and about DM4.1 million had been allocated.

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## WEST EUROPE/BIOTECHNOLOGY

### GROUPS VIE FOR SWEDISH BIOTECH, ENVIRONMENTAL R&D FUNDS

Stockholm NY TEKNIK in Swedish 8 Jan 87 p 8

[Article by Tina Lundh]

[Text] A tug-of-war is on to obtain government funding for biotechnology centers and an environmental laboratory.

Umea University is seeking support for its dioxin and biotechnology research. In Stockholm, the southern suburbs want to build the biotech equivalent of Kista. In Lund the university wants to invest in biotechnology for agriculture.

In the spring of 1987 the government will present a proposal on research policy. For this reason, proposals for professorships, laboratories, and research centers are flooding the Education Ministry.

For a long time now the government has pointed to environmental protection and biotechnology as prioritized areas and many people are now expecting money for research in these fields.

Last fall the National Committee on Biotechnology recommended spending 350 million kronor per year on research over a 10-year period. The committee wants the government to spend most of this money by way of the Board for Technical Development and the universities. The universities now receive money for biotechnology research from foundations, especially the Wallenberg Foundation, and from large companies.

"We have researchers and equipment here in Umea and we believe the government should follow through on its previous policy of moving research away from the metropolitan areas," Bjarne Kirsebom said. He was secretary for two study groups that proposed locating two research centers in Umea.

### Better Cooperation

FOA (National Defense Research Institute) research into atomic, biological, and chemical warfare is now conducted in Umea. Umea is also the site of the College of Forestry's research on plant breeding, environmental research by the National Board of Occupational Safety and Health, and molecular biology, cell biology, and environmental chemistry research by the university. The university is conducting the country's most advanced research on dioxins.

The first president of the university, Lars-Gunnar Larsson, was commissioned by the government to study the question of how these four research centers could cooperate better.

"It is strange that we do not cooperate more and, consequently, we want to stimulate cooperation now," Bjarne Kirsebom said.

The study recommends that the government provide 14 to 15 million kronor per year for research services, certain equipment, and administration, thereby forming two research centers.

"It may seem strange that we want money for coordination, since coordination would save us money," Bjarne Kirsebom said. "Of course, we will save money, but to the individual researcher the savings are not a sufficient stimulus. If money is given to coordinated projects, on the other hand, we believe that the savings would be systematic."

### Biotechnology Center

Those who conducted the study in Umea believe in the biotechnology center (also called molecular biology center), considering the research the agencies and the university are already conducting in that town.

"The government would save money if expensive equipment such as X-ray crystallography machines and double mass spectrometers could be purchased and used by several groups. We also believe there would be better dissemination of research results to industry."

The study from Umea is one of the first proposals that the Education Ministry is now considering.

"We will probably invest in more than one biotechnology center," said Bjorn Brandt of the Education Ministry. Recommendations have also come in from the municipality of Huddinge, the University of Lund, the University of Goteborg (professorship in molecular biology), and the University of Uppsala.

### Research City

"We hope to build a research city similar to the electronics research city of Kista," said Charlotte Munck af Rosenschold, director of information at the Biotechnology Center Foundation.

Its center at the Huddinge Hospital concentrates on medicine and animal vaccines. The municipalities of Huddinge and Botkyrka are recommending the construction of industry headquarters, research hotels, a train station, and perhaps even an airport for southern Greater Stockholm. The foundation believes that these projects should be given priority for reasons of regional development policy.

Umea University also cites regional development policy, particularly with regard to the environmental laboratory for dioxin research.



"Why should the National Environmental Protection Board build a laboratory in Stockholm when we already have one up here? That would be like crossing the river to get water," Bjarne Kirsebom said.

"No, we need a laboratory to make measurements in food, chemicals, and the environment."

He said that dioxin measurements (and research, of course) should continue in Umea, but the Environmental Protection Board needs a laboratory "close at hand with the authority of a governmental agency."

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## WEST EUROPE/CIVIL AVIATION

### MBB LAYS OUT POSITION ON AIRBUS FINANCING

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 18 Dec 86 p 17

[Text] In the discussions on financing of the Airbus project, the chairman of MBB, Hans Arndt Vogels, outlined the position of the company and its shareholders. He considers it unlikely that the shareholders would be prepared to help solve the pending financing questions by means of capital increase.

The company itself offered an amount of DM150 million in previous discussions with the Federal Economics Ministry, to retire the old debts from the financing of the Airbus A300 and A310 models. Vogels sees a readiness at the Economic Ministry to assume losses of DM2.25 billion within the existing credit guarantee. At present, the credit guarantee of just DM3 billion has been allocated, according to Vogels, and less than DM800 million is available for financing current assets.

For development of the two extended models, the A330 and A340, in Vogels' opinion the government will probably have to finance up to 90 percent, in accord with previous practice. This amounts to DM2.4 billion. MBB is supposed to supply the remainder of the German commitment of development funds. The final decision on this program is still pending, however, and is expected next spring.

Series production of the extended models should be financed by the industry, according to the Federal Government. The government has indeed offered some financing, but more cannot be justified. According to Vogels, a "protective screen" should be provided by the government. But no consensus has been reached on this topic. In discussions it has been proposed to provide the hoped for "moderate to significant" profits (depending on the dollar exchange rate) from the "smaller" Airbus A320, to the German Airbus GmbH, to be used for the series production of the A330 and A340.

The Airbus A320 is currently the star of the Airbus family. Another large contract valued at about \$1 billion will shortly be concluded with Japan's All Nippon Airways (10 fixed orders and 10 options). A total of 236 firm orders have been received for this model from 14 airlines. In the coming year, production of the first ten A320s will largely make up for the reduction in production of the A300 and A310 from 44 to 33 aircraft. By 1990 the annual production of the A320 will be accelerated to 66 units.

The unresolved outcome of the financing discussions will affect the total commitments and 1986 profits of MBB and may result in losses. The operative, partial results from production of the A300 and A310 will for the first time be almost or entirely compensated, even though the planned 1986 production of 33 aircraft was cut back to 28. It should be taken into account that MBB was paid in Deutsche Marks for its deliveries from the subsidiary Deutsche Airbus GmbH. A large part of the difficulties of the Airbus which have affected its competitiveness, resulted from the loss in exchange value of the dollar.

Since for the coming year, instead of the hoped for growth, a reduction from DM6 to 5.6 billion had to be calculated in, now defense engineering and phase-shifted depreciation in the space division will impede a growth rate of 18 percent. By 1990 MBB hopes to have sales of DM9.5 billion, with an overall slight reduction in personnel (currently 38,000 employees). But such a goal would force the MBB shareholders to consider a capital increase, which they evidently do not prefer.

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## WEST EUROPE/CIVIL AVIATION

SWEDEN: SAS ORDERS 12 MD-11'S, WORTH 10 BILLION KRONOR

Stockholm NY TEKNIK in Swedish 8 Jan 87 p 3

[Article by Lars Nilsson]

[Text] SAS is renovating its fleet of long-distance planes.

The company will purchase 12 McDonnell Douglas MD-11 airplanes.

The deal is worth 10 billion kronor and it is the largest individual order of airplanes in the history of SAS.

Because of the SAS order, McDonnell Douglas will now begin producing the MD-11.

For a long time, Douglas has required firm orders for at least 20 of the aircraft.

A Japanese leasing firm and British Caledonian Airways have previously ordered a total of 14 planes.

So far, the MD-11 is a pile of drawings on a desk in Long Beach. But Douglas intends to begin assembling the first plane in 1988. It is to be in the air 1 year later.

The MD-11 is not a totally new design. It is a modernized DC-10. It is a conventional three-engine jet that is now the backbone of the SAS long-distance network.

The first plane will be delivered to SAS in March 1991.

### Two Versions

The MD-11 will be produced in two versions: one that is just as large as the DC-10 and a smaller version with a longer range.

"In addition to coming in two versions, the MD-11 is a more modern plane than the DC-10. The engines are more fuel-efficient. The plane will also have a

new empennage and totally new instrumentation in the cockpit," said Ulf Abrahamson, who is responsible for planning the fleet of planes at SAS.

Saab of Linkoping has been involved in the MD-11 project in the past.

Now the company wants to become a Douglas subcontractor, instead.

Saab is now producing spoilers for the MD-80. The company now wants to do the same for the MD-11.

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## WEST EUROPE/COMPUTERS

### FRENCH SOFTWARE HOUSE ISSUES NEW STOCK

Paris LIBERATION in French 21 Oct 86 p 15

[Article signed J.J.C.: "A War Chest for the Computer Services Battle: Cap Gemini Sogeti To Increase Its Capital at the End of November"; first paragraph is LIBERATION introduction]

[Text] The Fr 489 million which the computer services company hopes to raise will enable it to consolidate its position as number one in Europe.

As planned and calmly announced last May by Serge Kampf, Cap Gemini Sogeti's (CGS) founder and CEO, this computer services company is going to achieve its Fr 1 billion war chest goal. In late November the company will seek to raise Fr 489 million in additional capital. To that amount must be added the Fr 600 million in bearer bonds issued last June. Together, that brings it to Fr 1 billion, and then some. The latest operation will not alter the distribution of the firm's equity, which is held 51 percent by Sogeti SA (controlled 66 percent by CGS management), 26 percent by Cap Gemini management, and 13 percent by CGIP, with the remaining 10 percent in public hands.

CGS shares traded at Fr 875 in the French "over-the-counter" market when issued in June of 1985; today the shares sell for Fr 2,090. The smiling fortunes of the Paris stock market provide an incentive for the firm to go on to new challenges and seize any opportunities to consolidate its position as the top European data processing service and consulting company (SSCI). Established in 1967 in Grenoble by Serge Kampf (formerly with Bull), Sogeti, which became Cap Gemini Sogeti following several mergers, recorded Fr 133 million in profits on Fr 2.2 billion in total revenues in 1985.

The company, which has subsidiaries in 10 countries, has 6,150 employees, including 5,000 engineers. That makes sense since CGS sells brain power--"intellectual services" as they say in the field. First, they must define the tasks which the customer company wants computerized--management, payroll, accounting, production, etc. Then programs must be written for the selected applications. Few companies--including some of the big ones, and especially the small- and medium-sized ones--have personnel qualified to do the job. Decisions must also be made on hardware requirements, computer capacity, overall system configuration, and applications software.

In most cases, such programs are not to be found on the market but must be tailor-made for the client firm. At times--as in the case of the computer systems for a large bank--such software runs to hundreds of thousands of lines of code on which several dozen programmer-designers have worked for months and sometimes for years. Cap Gemini Sogeti, like other SSCI's, supplies this type of expertise. Accordingly, its personnel is in large measure dispersed among its clients.

That is how CGS designed the first program for electronic directory consultation, like the one which manages the London Fire Department's alert system. CGS has even specialized in such work, abandoning other traditional SSCI activities such as the sale of machine time and data processing services for companies which do not have their own computers.

The growth of services and software (16 percent annually) is double that of hardware (+ 8 percent). Services and software represent 30 percent of company data processing costs in 1986. By 1990, this should increase to 45 percent. However, this growth is accompanied by changes in the field. First, because of the burgeoning share of microcomputers, broad distribution standard software (software packages) will offer stronger competition to custom software. To date, French SSCI's have had less success with the former than with the latter.

Second, falling hardware prices are driving computer manufacturers to shift to services and thus to compete with the SSCI's. The field is already crowded. Alongside an army of small firms, the top 20 French SSCI's account for 67 percent of revenues in the field. This trend is going to grow even stronger in the future. With a war chest of Fr 1 billion, Cap Gemini Sogeti is girding itself to do battle.

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## WEST EUROPE/COMPUTERS

### SWEDEN'S FIRST SUPERCOMPUTER AT NEW TECHNOLOGY CENTER SKERIA

Helsinki HUFVUDSTADSBLADET in Swedish 22 Dec 86 p 2

[Article by Ernest Uljens]

[Text] Skelleftea--In late January or early February next year business, technical universities, and researchers in Sweden will begin using a newly installed supercomputer in Skelleftea.

The computer is the first of its kind and will cost just over 70 million markkas. It has a capacity that is estimated to be 100 times greater than that of other computer units. It can make up to 1 billion calculations while analyzing changes in material strength.

The supercomputer is being installed as rapidly as possible in the basement of the computer firm Norddata, where no outsiders are permitted. It is called the IBM 3090 VF, where the initials VF stand for vector processor, which is the superstructure adapted to numerical calculations, which gives the computer its superior capacity.

The supercomputer will have an extremely broad range of applications in the area of high-level technical calculations. These include, for example, air flow calculations for the automobile industry, hydrodynamic calculations for ship manufacturers, medical research, evaluation of satellite pictures, meteorology, the mining industry, industrial design, and research that is conducted at technical universities.

The supercomputer is the latest addition to the computer and training capacity that has been built up in Skelleftea for small and medium-size companies. The computer is manipulated from IUC--Industriellt Utvecklingscentrum--which is one of the four pieces of the puzzle forming the development center called Skeria, which is an abbreviation for Skelleftea Education and Research for Industrial Applications.

In addition to IUC, Skeria consists of TTC or TrateknikCentrum, which does testing, development, and research in wood materials, and HLu, an abbreviation for the Lulea Technical University's unit for training in civil engineering and wood technology. The fourth piece of the Skeria puzzle is SCS or Studiecentrum Skelleftea, which conducts corporate-oriented training in technology and economics both at the university level through correspondence training and through courses at the high school level.



## Island Of Opportunity

Skeria in Skelleftea bills itself as the Island of Opportunity. The symbolism in the name is related to the island of Skeria in the Ionian Sea off the western coast of Greece, which is now better known as Corfu.

The island and its people were given a major role in Homer's great epic the Odyssey, which describes how Zeus and Athena save Odysseus from being swallowed by the sea god Poseidon and take him to the island of Skeria. From Skeria, Odysseus returns to his home island of Ithaca, where the hero is reunited with his Penelope.

## Development Center Next Step

Since it began 15 years ago, IUC has concentrated on individual inventors and companies with fewer than 50 employees.

Svenerik Sahlin, IUC executive vice president, is convinced that a continuous increase in the level of technology is needed in order to give Norrland firms the competitive strength they need.

As part of this work, Skeria's facilities will be complemented by a development center, where the buildings and facilities will be rented to companies that wish to take advantage of the CAD/CAM resources that IUC has to offer.

## CAD Graphics, Symbol Library

The dissemination of technology through training is now a real concept in Sweden, where research centers, corporate parks, development centers, corporate hotels, and similar objects have sprung up everywhere as part of the increasing cooperation between universities and companies.

IUC in Skelleftea is now training nine companies in Vasterbotten and Norrbotten in electronic design directly in the silicon, which is the latest innovation in this field. In addition to IUC, only Ericsson, Asea, and other giant corporations are working with this technology.

IUC offers equipment for producing three-dimensional color pictures with CAD graphics, which companies can use for making bids.

A cabinet maker with three employees recently made use of the CAD graphics station by having the computer draw pictures from designs, rather than having his workers make prototypes of shop counters.

IUC also offers drafting machines. A CAD symbol library is also available in conjunction with these machines.

"If a designer wants to draw a gear or a gearbox, he does not need to draw the standard components that are already available, for example, for ball bearings. Once he has decided what type of ball bearing he wants to put in, he can take a drawing from our symbol library," Svenerik Sahlin said.

He mentioned in this connection that IUC had placed every type of ball bearing produced by SKF into the CAD system.

#### Cooperation With Companies

Since last fall IUC has had a training section that tailors its training in CAD/CAM, i.e. computer-controlled design and manufacturing, to the user in the fields of hydraulics, pneumatics, electronics, numeric control technology, control and regulation technology, automation, and robot technology. Early next year a 22-week continuation course will be held for designers, primarily in the manufacturing industries.

#### Europe's First Computer Tomograph For Industry

Together with the County Council of Vasterbotten, IUC has acquired a so-called computer tomograph, the first in Europe for industrial use. The computer tomograph is used for health care in the morning and by IUC to examine construction material in the afternoon!

"The computerized tomograph is a three-dimensional picture in which we can select the desired segment. We can open up the material and look at it from the inside. The computer in the tomograph reads the exact density in the structure. We believe the tomograph will increase our companies' understanding of new materials," Svenerik Sahlin said.

#### How Much Can Tow Hook Withstand?

The IUC chief sees the acquisition of supercomputers as an absolutely necessary prerequisite for giving Swedish companies the ability to compete. In order to demonstrate the capabilities of the computer, he took the example of a tow hook. The problem was to determine how much weight it could bear and the changes the material in the hook would undergo during increased loading.

"The tow hook is divided into an almost infinite number of small cubes. The computer calculates changes in the material in each cube."

"If we want to make 4,000 consecutive calculations, it takes 25 minutes with the equipment we now have. If an engineer wants to make 1 million or 1 billion calculations, then we are moving into the supercomputer class in which changes in the material are calculated in milliseconds," Svenerik Sahlin said.

By December of this year, six supercomputers will have been installed in Norway. In Sweden the question has been discussed and studied for 6 years and nothing happened until Skelleftea took the initiative and snatched the supercomputer from under the nose of Umea, where acquisition of a supercomputer has been discussed for 2 years.

## Fittings For Cologne Concert Hall

We can conclude this report on our visit of several hours to Skelleftea by relating what can almost be called a charming little story.

Fourteen cabinet makers in the Skelleftea region joined together to form the Skelleftea Cabinet Makers' Center, which successfully competed for the job of outfitting Cologne's new concert hall.

Both the companies and the computer technology of Skeria were mobilized to draw up the bid. Laser and CAD technologies were used to design the fittings. All the many individual elements came together to help the cabinet makers' center land this major order.

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## WEST EUROPE/COMPUTERS

### NORWAY LOSING MARKETS IN INFORMATION TECHNOLOGY

Oslo AFTENPOSTEN in Norwegian 29 Dec 86 p 13

[Article by Ulf Peter Hellstrøm under the rubric "Information Technology--Our Industrial Challenge": "A Technological Revolution in the Doldrums"]

[Text] "Information technology" has become one of the time's new catchwords. Mainland Norway is to work its way through the economic ice age in the wake of the oil age through the development of knowledge-based industry. Now the political parties, too, have placed their stakes on this new technology, which really covers a profusion of closely related industries and services. Norway is to undergo a revolution in the doldrums. Information technology is already upon us--both in the form of computer-controlled lathes in tradition-rich industrial concerns, bank branch offices and yuppies' office scenery. But how will the really industrial nation of Norway be able to utilize the new information technology, and what will be the consequences of hanging along in the fast computer age?

Sixty thousand new jobs before the year 2000, say authorities and industry people. Estimates show that this can be the outcome of a national all-out effort to rearm the country's knowledge-based industry. The government has set the stage for a national action program to the year 1990 which will cost a total of about one billion kroner, in Norway's endeavors to keep up with the gigantic race to become the leading so-called IT nations after the turn of the century.

#### Vague Concepts

What the billion will really be used for can still seem somewhat vague to many. The very concept of information technology perhaps also belongs to the realm of the land of fog and mist for some of us. In their book "Revolusjonen som forsvant--EDB, informasjonsteknologi og samfunn" [The Revolution Which Disappeared--Electronic Data Processing, Information Technology and Society], editors Knut Holtan Sørensen and Per Morten Schiefloe take a stab at the following definition: "Information technology is the branch of knowledge concerning tools and methods for producing, processing, representing, transferring, storing and retrieving information." However, in practice information technology does not concern just knowledge of how information can be processed, but also of specific technical tools, like computers and other

hardware products, for example. In reality it also includes old-fashioned aids like abacuses, filing cabinets, etc. The authors believe that this point can serve as a caution against thinking that all information technology is of recent date, or that technology concerns just expensive technical products.

### Microelectronics

Information technology has its source first and foremost in microelectronics, which developed after the war. Integrated circuits and microprocessors are kingpins of the new technology. Communication capabilities are coming in besides as an ever more important part of the whole. And in order for the hardware products to be able to function, a forest of software companies has grown up the world over, which through their system packages or specialized programs get something useful out of all the computing capacity.

According to earlier estimates, the computer industry employs about 50,000 people in Norway. The Electronics Industry Branch Association (EBF) offered lower estimates previously (but this branch association does not include big subsidiaries of multinational firms, like IBM Norway). However, if all those are included who process information in various ways daily, or who use computer technology products as aids in their work, the majority of the actively working population is probably affected by information technology.

The Norwegian computer industry is still small on the international scale, but is growing. The flagship is Norsk Data, but there is a swarm of new small companies, especially in the research environments around NTH [Norwegian Technical College] in Trondheim, Oslo, and in Norway's little answer to Silicon Valley, Horten.

### Losing Markets

The problem is that the Norwegian industry is losing market shares all the time--not just in the growing export markets, but also in the Norwegian domestic market. It is first and foremost this development which provoked the industry's warning call to the politicians. The future-directed growth industries are escaping the notice of raw-materials-oriented Norway. Then the basis for the welfare state will crumble away in the course of a generation or two. "We must not become an assembly nation," Industry Minister Finn Kristensen said, and he has many with him in that.

The national staking on information technology has broad political support. However, such a national all-out effort assumes close teamwork between the State and industry, such as has been seen in countries like France and especially Japan.

Opinions can be divided regarding how central a role the authorities should play. Some will claim that the authorities must play a central, controlling role, especially in Norway, where the industrial structure is dominated by small firms with limited resources. Others will place the main emphasis on creating scope terms which will give the so-called founders and the rest of industry a free hand. It is really a question of industrial policy and economic policy in the broad sense.

## Uncertain Effects

The effects of the future's information society appear rather uneasy to grasp. Even so central a question as the effect of automation on employment provokes disagreement among researchers. Some caution against crack efficiency. Others place the main emphasis on the new demand for ever new services and products which the new technology will create, and which will again create jobs. AFTENPOSTEN has earlier published the results of studies in Kragerø, for one thing, (conducted by the Norwegian Central Accounting Office) which seem to indicate that computer technology has a very limited affect on employment.

EBF computed earlier that Norwegian imports of foreign information technology and products at the turn of the century will be greater than the value of Norwegian oil and gas revenues, in any case if Norwegian industry continues to lose market shares at the same rate as before.

The drop in oil prices has made these visions of the future even more ominous than when they were presented last summer, when oil prices were safely about \$30 a barrel.

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CSO: 3698/215

## WEST EUROPE/COMPUTERS

### ESPRIT PROJECT: PARALLEL ARCHITECTURES, LANGUAGES

Le Chesnay BULLETIN DE LIAISON DE LA RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE in French Jan 86 pp 16-17

[Article by Jean Rohmer, Bull Research Center, 68, Rue de Versailles, 78430 Louveciennes: "Some 84-85 Projects, Parallel Architectures and Languages for Advanced Information Processing, a VLSI (very large scale integration) Approach"]

[Text] The 415 project is certainly one with one of the longest titles, largest budgets, and most ambitious objectives. The objective is indeed clearly to gain a foothold in the area of Japanese fifth-generation parallel architecture projects.

However, it differs from the Japanese projects in some important aspects:

1. The similar Japanese projects (PIM: Parallel Inference Machines) all have the common objective of using PROLOG language. They differ in the strategy selected for the implementation of PROLOG;
2. The 415 project does not exercise much specialization with PROLOG. In contrast, starting from the level of an extremely high-level language, its goal is to explore:
  - (a) The power of expression of parallelism in various languages,
  - (b) The architectures best adapted to the parallel execution of these languages, and
  - (c) The application areas which may require the use of such languages with such machines.

In the current phase of the project (5 years), it was decided that instead of jointly designing a unique architecture, each team would be allowed to explore a particular approach. In an eventual second phase, the design of a joint project will be considered, in light of the experience acquired.

## Working Groups

Although the machine projects are independent, a significant amount of the teams' time is spent jointly in specialized working groups: architecture and applications; semantics of parallel programs; and verification of parallel programs.

These working groups are directed by and presided over by renowned academicians (Prof DeBakker, Prof Trealeven).

These working groups are also responsible for organizing summer schools which are open to project members as well as to outside researchers. In 1985, the semantics group organized a 2-week school session in the Netherlands, and the architecture group will hold its summer school session for 2 weeks in June 1986 in Italy.

Project meetings are held often, and are the occasion of real joint work. Thus, the architecture group is involved in a systematic comparison of languages and architectures selected from cases of common form, from theoretical examples (sorting algorithm) to complete applications (circuit simulators). For each application studied, the qualitative aspects (readability, conciseness) and quantitative aspects (speed, memory requirements, communication rate, parallelism) are evaluated and compared for each of the architectures.

### Six Subprojects of Esprit 415

#### Subproject A (Philips and AEG)

The language selected is a relatively low-level language, designed to use explicit parallelism in machines having up to 1,024 processors.

#### Subproject B (GEC)

The language selected is of the operational type. A joint parallel architecture project is planned over the long term, because it allows for implementing up to 10,000 processors on one silicon wafer (WSI: Wafer Scale Integration).

#### Subproject C (Bull)

This involves constructing a parallel machine for logic programming, thus for executing PROLOG, as well as inference engines and deductive data bases. The number of processors planned is between 8 and 256.

#### Subproject D (CSELT)

This project is concentrated on the design of a language which combines functional and logical programming styles, with the idea of assigning algorithmic problems to the former and non-deterministic problems to the latter.



### Subproject E (Nixdorf)

The goal is to study the use of an operating language with data flow architecture.

### Subproject F (Nixdorf)

This project will attempt to construct an architecture for first order logic based on the "Connection Method" inference method proposed by Bibel at Munich TU [Technical University].

The project's main contractor is Philips. Several subcontractors are associated with the project. In France, they are ESIEE [Advanced School for Electrical and Electrotechnological Engineers] for Bull and LIFIA for Nixdorf.

Certain projects explicitly call for the construction of prototypes (particularly Philips and Bull), other projects plan to limit themselves to hardware or software evaluations and simulations.

Although the different projects have different premises concerning the choice of programming style, they agree on the choice of general architecture:

1. An architecture is composed of a group of modules, which are all identical within a given project, and a general purpose interconnection network between these modules;
2. The modules exchange messages, and each module can communicate with all the others;
3. Each module is "PCM," that is, it has calculating power (Processor), a Memory capacity, and the ability to receive and transmit messages (Communication).

The project represents a total of 277 man-years of work, for a total cost of 33 million ECU.

### Some Details of the Bull Project

The purpose of the C project carried out by Bull is to achieve a parallel machine for logic programming with relatively short-term goals, because an experimental model could be working by the end of 1987. This project is being carried out at the Louveciennes Research Center, in the Artificial Intelligence Department of the Directorate of Architecture and Software Research.

Originally, the idea was limited to the construction of a parallel relational data base machine, with the extension of the Schuss project, a masking and linking processor. For this reason, the project is also known as the Multi-Schuss.

This idea has developed in the direction of the definition of a parallel machine for logic programming in several stages: determination that the deduction mechanisms at saturation (or "forward chaining") could be reduced to relational operations, as was done with the BDGEN system of CERT [Centre d'Etudes et Recherches de Toulouse: Toulouse Research and Study Center] and with the BOUM inference engine at the Bull Research Center; and development of a method (called the "Alexandre Method") for relating the backward chaining (with PROLOG) to forward chaining, including the case of recursive rules. Finally, apparently an interesting architecture can be justified by considering as base language extremely simple production rules of the form:

$$PQ \Rightarrow R$$

or more generally with variables:

$$P(x,y) Q(y,z) \Rightarrow R(x,z)$$

The basic operation of the machine will consist of saturating a group of facts by using a group of such production rules only in forward chaining. This level of language has many interesting properties: it expresses parallelism; it expresses associativity (associative searching); it is extremely simple; and it is similar to high-level languages (PROLOG, inference engines, operational languages) as well as to well-known hardware or algorithmic mechanisms (masking, linking). The basic idea for its execution is to design an architecture that, as distinct from data-driven or demand-driven architecture, we call:

#### DELTA-DRIVEN ARCHITECTURE

The principle consists of using the rules to produce new facts (DELTA-facts), which can then initiate new rules, and so on. Thus, for every rule of the form:

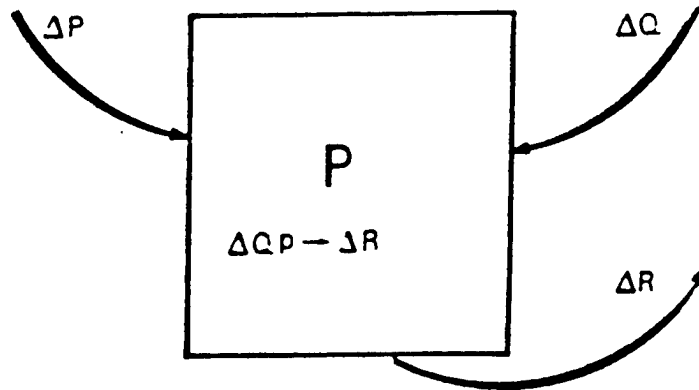
$$PQ \Rightarrow R$$

there are two corresponding DELTA rules:

$$\Delta PQ \Rightarrow \Delta R$$

$$\Delta QP \Rightarrow \Delta R$$

To each precondition, P, Q, or R, we can then associate, virtually or physically, a module which will transmit and receive DELTA facts. Thus the following DELTA-DRIVEN diagram is obtained:



It is planned that each elementary processor be made with a Motorola 68020 processor and a VLSI processor which was also developed at the Bull Research Center, designed for symbolic processing.

Project Number: 415 A 84

Title: Parallel Architectures and Languages for AIP-A VLSI Directed Approach

Consortium:

Philips  
AEG Telefunken  
Bull  
CSELT  
General Electric Co.  
Nixdorf  
CWI Amsterdam  
LIFIA  
Stollman  
Univ. of Berlin  
Univ. of Pisa  
Westfield

Netherlands  
West Germany  
France  
Italy  
United Kingdom  
West Germany  
Netherlands  
France  
France  
West Germany  
Italy  
United Kingdom

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CSO: 3698/072

## WEST EUROPE/FACTORY AUTOMATION

### SURVEY OF ITALIAN ROBOT INDUSTRY

Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Feb 86 pp 76-78

[Text] As a result of the survey conducted by UCIMU [Italian Machine Tool Builders Association] and SIRI [Italian Industrial Robotics Company], the Italian robot has now been issued an identity card which, detailing its characteristics and distinctive features, should help it acquire the rights to which it is entitled by virtue of the role it is fulfilling.

Indeed, the robot, together with the machine tool, is the leading figure in the evolution of the factory towards the "automatic factory." Its importance goes beyond its ability to relieve humans of extremely arduous or hazardous tasks: The robot is the mechanical "being" that enables the coordinating and tying together of the various phases of the productive process, which can thus be addressed in a new light, as a profoundly integrated "whole."

In Italy, the number of robot-producing firms as of yearend 1984 totaled 42, according to the findings of the thorough survey, with employees numbering 1,260, and billings totaling 90 billion lire during the last year of the period surveyed, for 1,220 robots sold on the domestic and foreign markets.

Born around the beginning of the 1970's, the Italian robotics industry experienced its greatest growth during the second half of the decade, and differentiates itself from its competitors (as do other components of our productive system) by its substantial number of small-sized firms, alongside which, however, larger complexes operate that have sprung up, generally speaking, from within the ambit of user sectors.

The lion's share of the latter complexes has been generated, for the time being, by the automotive industry and the automotive parts industry, which together absorb close to 50 percent of the robots, 1,090 models of which were installed in 1984, for an overall value of 78.5 billion lire; future absorption by the various productive sectors, however, is expected to develop along more balanced lines.

The UCIMU-SIRI survey also makes possible an analysis by typology of the product. Thus, it is found that, of 1,090 robots installed as of last year,

735 have complex technical characteristics, and 355 are of simpler design (fixed-cycle mechanical arms).

Thus, in Italy, two of every three installed robots are machines of an advanced nature, designed, with various levels of sophistication, to feed operating machines (25 percent), and to perform welding operations (18 percent) and assembly operations (7 percent). Excluding fixed-cycle mechanical arms, robots for loading and unloading operating machines represented, during the 2-year 1983-84 period, 30-37 percent of the total Italian consumption, welding robots 27-31 percent, and assembly robots 10-15 percent.

The Italian robot's "identity card", developed by UCIMU and SIRI with the full cooperation of the producers and of the 14 importers interviewed, provides other, extremely significant, data: In 1984, 370 robots were exported, for a value of 41 billion lire; billings on the domestic market by Italian producers totaled 49 billion lire (for 850 robots); 240 robots were imported from abroad, for a total of 29.5 billion lire. The trade balance thus made a positive gain of 11.5 billion lire; exports accounted for over 45 percent of total billings, while imports amounted to less than 38 percent of domestic consumption.

This decidedly positive profile of the Italian robotics industry is marred, however, by a deep "wrinkle" which stems from the same concerns frequently voiced by the other producers in the vanguard of our technological growth: Sufficiently selective incentives, capable of giving rise to complex investments such as those involved in automation, are lacking in Italy.

The situation is vastly different in the other industrialized countries, where incentives are operative that are designed both to stimulate demand for and to enhance the supply of automation. In the principal European countries, in particular, governmental intervention operates in at least three directions: Support of research and development of new automatic production systems, stimulation of demand, and enhancement and restructuring of supply.

The "substantialness" of these interventions are respectable by any standard: In the Federal Republic of Germany, for example, the "Production Technology" program, between 1980 and 1983, provided 163 million marks in grants for the development of new productive solutions and led to the launching, beginning in 1984, of a new form of incentive, which grants subsidies for applications of CAD, robotics and automation, covering up to 40 percent of the cost of the project. In Great Britain, the "Flexible Manufacturing Scheme" earmarked 80 million pounds sterling to promote FMS installations during the period 1982-1986.

In France, where there are actually two intervention programs, "Anvar" has a total funding capability of 900 million francs for subsidizing innovation in the manufacturing technology sector, while the "Codis" program covers development contracts with a budget of 100 million francs. Also, in France,

added to subsidies for promoting research and demand are funds in substantial amounts earmarked for the restructuring of supply. The "Machine Tool Program" was allocated 2,300 million francs to reorganize the sector's industry between 1982 and 1985.

Within this frame of reference, Italy figures in a particularly weak position, having remained anchored to a law of assured effectiveness with respect to investments--the Sabatini law--but not specifically designed to promote automation; law 696 was added to it temporarily and has since expired. The UCIMU-SIRI survey, which is to be updated regularly on an annual basis, therefore proposes, in addition to many innovations, a reality which, although now old, unfortunately never ceases turning up as a current need: The need, in our country as well, for the setting up of incentives and subsidies such as will motivate those who would invest capital in the development of new productive solutions; their investment, by improving our industry's competitiveness, actually ends up concretely supporting the Italian economy.

UCIMU; V.le F. Testi, 128; 20092 Cinisello Balsamo (MI).

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CSO: 3698/91

## WEST EUROPE/FACTORY AUTOMATION

### ITALY'S ROBOT MANUFACTURERS

Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Mar 86 p 196

[Article: "Lombardy's Robotics 20"]

[Text] There are now almost 20 firms in Lombardy [see listing below] engaged in industrial robotics or hardware interconnect activities--in other words, those activities one tends to identify under the term "automation of the discrete-product factory." The provinces involved are five: Milan, Varese, Brescia, Como and Pavia. The firms are of medium-to-small size, and the typology of the clientele served is varied instead of rooted in the automotive industry as in the case of Piedmont. A typical producer of robots (pneumatically-, hydraulically-, and electrically-powered) is Paderno Dugnano's Camel Robot company, which has recently expanded its offering with the introduction of IBM robots for the handling of lightweight parts and prides itself on the installation of almost 300 systems to date. Ken is the robot developed by Cremona-based AISA: It can handle parts weighing up to 20 kg. Geometric control robots and automatic systems for integrating the operation of machine tools are built by Pavia-based Speroni, which exports them to all parts of the world. Punch-press feeder robots for the stamping of sheet-metal blanks are offered by Brescia-based Norda. On the whole, what is involved is a treasure house of know-hows, capabilities, and resources, that must be safeguarded and helped to grow, through subsidies by the Regional Administration, which, having demonstrated its awareness of this reality, should follow up with more concrete evidence of an industrial policy.

#### Lombardy's Robot Producers

<u>Firm</u>	<u>Location</u>	<u>Product(s)</u>
ADI	Azzate (VA)	Parts handling, machining and painting robots
AISA	Cumignano (CR)	Parts handling robots and assembly lines
BERARDI RINO	Brescia	Machine tools and FMS's

Lombardy's Robot Producers [cont'd]

<u>Firm</u>	<u>Location</u>	<u>Product(s)</u>
CAMEL ROBOT	Palazzolo Milanese (MI)	Parts handling robots
CEMSA	Cologno Monzese (MI)	Flexible automated assembly and welding machines
D'ANDREA	Lainate (MI)	Measuring systems and cutting robots
DUPLOMATIC	Busto Arsizio (VA)	Parts handling robots
FIAR	Milan	Assembly systems - PLC
GAIOTTO IMPIANTI	Crema (CR)	Painting and enameling robots
ICOMATIC SpA	Gussago (BS)	Parts handling robots
NORDA	Brescia	Parts handling robots
RAFRA INDUSTRIALE	Cura Carpignano (PV)	Parts handling robots
SLS di Trevisan	Gazzada (VA)	Parts handling, machining and painting robots
SPERONI	Sostegno Spessa Po (PV)	Measuring machines
TAU	Milan	Integrated parts handling installations
TECNOGAMMA	Mainate (VA)	Parts handling robots
OLMI	Civate (CO)	Assembly-line tooling and machines

Source: MEDIA 2000.

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## WEST EUROPE/FACTORY AUTOMATION

### SESAM'S INDUSTRIAL AUTOMATION STRATEGY SUMMARIZED

Milan AUTOMAZIONE E STRUMENTAZIONE in Italian May 86 p 82

[Text] The electronics sector "weathermen" are forecasting that in Europe over the next 5 years the industrial automation market for the medium-sized firm will increase sixfold (from \$2.2 to \$13 billion), creating investment opportunities that are potentially covered only in part at present. This contrasts with the situation that characterizes the big-industry automation market where larger forces are present and where strategies and adoptable solutions are more easily visible.

It is the market for the medium-sized firm that is being eyed by SESAM, the company created recently by Comau and Digital Equipment on an equal-partnership basis to develop and sell integrated automation systems designed for the manufacturing industry. The strategy of this firm, which undoubtedly encompasses within itself all the necessary factors for rapid growth, not only in Italy but also abroad, is still not clear to everyone. In the light of the information developed during the first few months of 1986, the following principal aspects would seem to characterize SESAM's strategy for positioning itself in the market:

--"Pure" marketing of products built by Comau and Digital, with a dual advantage over other operators competing in the same sector: Better knowledge of the products through easier accessibility to the required information, and advance knowledge as to availability of their products (from 6 to 12 months --a far from negligible lead time, considering the quick conversion and renovation times required by the market being addressed);

--Developing of its role as a "main contractor," thus positioning itself as sole partner of the user who demands a complete applicative solution, with broad use of the subcontractor for the various components needed for its implementation. It would appear that this is the role SESAM will seek to promote, so as to avoid, to the extent possible, head-on competition with engineering houses and automation and data processing companies marketing individual component products;

--Providing of consulting and study services in the industrial automation sector, with regard not only to users but also to shareholders, to whom

a steady flow of operational information from those operating constantly in contact with the market--in other words, functioning as a feedback loop and probe for gauging user dispositions and responsiveness;

--Research and development activities based on two fundamental criteria: Specificity of the project and extensive cooperative involvement, aimed at creating new know-how and resources;

--As its operating terrain, SESAM has chosen that of productive processes of a mechanical or closely allied type, hence broader in area than the one in which Comau operates, but, in substance, part of the same furrow. Other initiatives will probably be launched to operate in other sectors, if experience validates SESAM's choice, functionally as well as strategically.

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## WEST EUROPE/FACTORY AUTOMATION

### EUREKA CIM PROJECT JOINS NINE COMPANIES

Brussels NOUVELLES DE LA SCIENCE ET DES TECHNOLOGIES in French Sep 86 pp 97-98

[Article from ABSY [AB Systems of Brussels]: "EUREKA Creates PARADI"]

[Text] At the dawn of the third industrial revolution, our industries are turning to the most recent telecommunications and data processing resources as they prepare to undergo widespread structural changes.

These techniques will, in fact, no longer increase profitability merely by increasing production capacity, but especially by introducing a flexibility which will also allow a larger number of medium-size plants.

The concepts behind CIM (Computer Integrated Manufacturing) and FMS (Flexible Manufacturing Systems), which will enable us to reach these admittedly ambitious but now realistic goals, require very extensive research.

A recent EEC study clearly indicates that widespread application of various technologies resulting in a true CIM environment could increase productivity by more than 200 percent, at least equaling the gains of the preceding industrial revolutions.

Moreover, quite apart from these figures, which some might still consider utopian, these techniques will significantly improve the situation in inventories, materials being processed, manufacturing time, quality, etc.

To meet this new and imposing challenge, PARADI was established as a EUREKA project. The French expansion of the acronym reflects the project's major goals: Controlled From Upstream, Regulated From Downstream, Decentralized, Interactive.

Because of the very effective actions of the SPPS [Science Policy Planning Service], Belgium will participate as a full partner in this project through the ABSY company. France's Aerospatiale, which originally proposed the project, will manage it.

ABSY's participation in a European project of this scope will enable it not only to become familiar with new techniques, but especially to establish relationships with European companies and thus better mutual understanding of

respective philosophies. This will be a determining factor in development of exports in this field.

Five countries and nine companies will in fact participate in this project with total investments of some 1.3 billion Belgian francs.

France, with Aerospatiale as project manager, Bull, and Renault Automatisation SERI will concentrate on planning (following the Kanban method), downstream linkages, subcontractor relations, and development of a true expert system which will integrate the know-how of the shop managers.

The Swiss Brown Boveri company will study flexible transfer in electronic manufacturing. Aeritalia in Rome will further apply Kanban, and the Spanish company Matrici will develop the upstream CAD link.

West Germany's MBB and IKOSS will be part of the main group studying the basic design and general architecture.

As for the Belgian company ABSY which developed and refined the CRYSTAL equipment used in the implementation of monitoring and process control systems and is well suited for production management, it will play a dual role:

-- On the one hand, because of its experience in industrial networks, particularly its role in developing the Belgian RAPIERE network, ABSY will coordinate research on the various networks needed for implementation of hierarchical structures;

-- On the other hand, together with a small- or medium-sized Belgian company still to be chosen, ABSY will adapt general principles to the needs of small- and medium-sized industries.

The EUREKA project now stands with the major European projects ESPRIT and BRITE. More practically oriented, it has opened the door wide to medium-sized companies which have a decisive role to play in it.

Convinced that this project will prepare Belgium and ABSY to effectively meet the very important market emerging with the factory of the future, we would like to take this opportunity to invite proposals from small- and medium-sized companies interested in working with ABSY to study and apply PARADI principles.

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## WEST EUROPE/FACTORY AUTOMATION

### BRIEFS

ESPRIT'S INDUSTRIAL COMMUNICATIONS NETWORK--A group of 10 European countries--Aeritalia and Olivetti for Italy--has begun working on the CNMA [Communications Network for Manufacturing Applications] project, to develop an industrial communications network, with funding to the extent of some 20 billion lire by the EEC under the Esprit program, for a market that is expected to grow from some 30 billion lire in 1985 to over 400 billion lire by 1990, according to estimates made by the French BIPE institute. The CNMA project is a response--not the only one--by the Old Continent to the American MAP. The project, which is headed by British Aerospace, will be ready for demonstration and comparison with competitive systems as early as 1987 and has as its aim to yield applicative aspects as directly as possible. Another similar study is being pursued by a group of 20 companies headed by France's Aerospatiale. It is the OSA [Open-System Architecture] project, whose objective is to develop an industrial communications standard conforming to ISO standards. [Text] [Milan AUTOMAZIONE E STRUMENTAZIONE in Italian Jun 86 p 106] 9399/6091

CSO: 3698/91

PHILIPS MOVES TOWARDS MEGABIT-CHIP PRODUCTION

Amsterdam DE VOLKSKRANT in Dutch 6 Dec 86 p 33

[Article by Broer Scholtens: "The Megabit-Chip Is Simply a Jigsaw Puzzle"; first paragraph is introduction]

[Text] On Tuesday, a new chip center went into operation in Eindhoven. It is there that the first chips containing millions of transistors are to emerge from trial production at the end of 1988. For the moment, Philips is doing well in the international race of compressing circuits on one square millimeter. Broer Scholtens had a look around in the submicron realm.

The first megabit circuits, chips with millions of transistors on a minuscule plate of silicon, will emerge from the Philips trial production facility in Eindhoven at the end of 1988, ready for testing by clients. With this schedule, Philips is keeping pace with foreign competitors in acquiring production know-how in the submicron realm.

What is involved is knowledge of production processes whereby circuits can be drawn on a silicon chip with structures that are smaller than one micron, one-thousandth of a millimeter. In comparison, a human hair is one hundred times as thick (70 micrometers). If you have that know-how, you can squeeze millions of transistors onto one chip. This megabit technology is necessary for a company to be able to continue playing a significant role on the international chip market over the next 10 years.

Philips is one of the 10 biggest chip producers in the world. "We believe that we will be able to remain in the top 10 in the years ahead," says Dr S. van Houten, member of the board of directors of Philips, during the opening of the new center for basic and applied research in the area of integrated circuits (chips). This megachip center was officially put into operation Tuesday by Prince Claus.

The center contains a design department and a test production plant where the megabit-chips can be made. The construction and furnishing of the center cost a half a billion guilders. Philips is conducting its research and development work in conjunction with Siemens, the West German electronics firm. The two companies are investing more than one and a half billion guilders in this

project over the coming years. The German and Dutch governments are providing a half a billion guilders.

The megabit-chips that will soon be leaving the Philips trial production facility will be produced on a large scale in Nijmegen and Hamburg at the end of the 1980s. A chip factory is under construction in Nijmegen. A billion guilders have been set aside for that through the end of the 1980s. Preparations are underway for a new chip factory in Hamburg.

As the compression of circuitry on a one square millimeter silicon chip intensifies, more and more money is needed in order to master the corresponding processes, and the buildings needed for research and production become proportionately larger. Since the beginning of the 1970s, a new generation of integrated circuits has appeared on the market every 3 to 4 years. The smallest detail that could be formed on a chip of silicon in 1970 on the basis of the know-how then available measured 10 to 20 microns, one- to two-hundredth millimeters. Using this, it was possible to produce memory chips with a thousand transistors.

Since then, technological developments have proceeded at an accelerated pace. In 1980, process techniques were introduced in factories making it possible to form details of as small as two microns on a chip of silicon, good for 16,000 transistors on one chip. At present, memory chips containing 64,000 to 256,000 transistors are produced on a large scale. It is hoped that that figure will be expanded by the end of the 1980s to millions of transistors, on a surface of no more than 60 square millimeters of silicon.

Each generation of chips requires its own production process, which becomes increasingly intricate. This involves placing the design patterns on the silicon chip using lithographic processes, evaporating a number of substances, precipitation-hardening light-sensitive lacquers in ovens, exposing that lacquer to light in order to place structures on the silicon chip on the basis of the design, etc. In this way, around a thousand chips come from a round plate of silicon, all with the same design. The chips are sawed apart, tested and put into a casing, ready for the user.

At the beginning of the 1970s, it was still possible to produce chips with line widths of 10 microns using 50 process steps. The increase in the number of process steps is of enormous consequence with respect to the precision of the overall procedure. There are 200 process steps in the production of the current generation of chips. If the average efficiency rate of one process step is 97 percent, meaning three percent waste at each step, then only one percent of all the chips on the silicon plate will ultimately be usable.

For megabit-chips in the submicron realm, there are 300 process steps. Based on an output efficiency rate of 97 percent, this means that only 0.1 percent of the chips will be usable. In the rest of the cases, an error occurs somewhere in the production process. Those chips are discarded. In the chip factory, 50 to nearly 100 percent of the chips resulting from mass production must be usable, depending on the design of the chip. This means that an intense effort is necessary in the production of megabit-chips so that all 300 process steps can be conducted with greater precision.

Chip production is almost entirely automated. It is very important that work be done in an exceedingly clean room. The demands placed on such a production room are extreme. In the production of megabit-chips, there can be no more than 35 dust particles measuring a half a micron in each cubic meter of air. A cubic meter of air normally contains 1 to 10 million of these particles.

This means that the air in the working area passes through various filters, which remove nearly all dust. At the Eindhoven chip center, almost three million cubic meters of continually filtered air an hour is pumped through the rooms. The people who work in the dustproof room are clothed in dustproof jackets, shoes and mouth and nose coverings, as well as the well-known caps. Beards and moustaches are taboo.

Just like in the hospital operating room, only a number of magnitudes cleaner. Before anything or anyone can enter the clean room, it or he must first be decontaminated. There are three steps, consisting of dressing and undressing rooms and air blowers. The gases, liquids and equipment that are brought into the room must also be extremely dustfree. Keeping the rooms clean is a technology in and of itself.

In the chip center's clean room there is a production line where test series will be made. The designs for them come from computer-controlled drafting machines, which represent an enormous reduction in design time. In October, the first silicon plates came off the production line, for the time being with details measuring only two microns. The next step is to prepare for production the processes based on details of 1.2 microns, following by the plunge into the submicron realm, aiming for 0.7 microns.

Philips, in conjunction with Siemens, is working on overtaking both Japanese and U.S. companies in the area of chip design by putting submicron technology into production. Philips is thus aiming at the development of the one-megabit static RAM, while Siemens is going after the four-megabit dynamic RAM. The same technology is needed for both memory chips.

The development of the memory chip is not an end in and of itself for Philips, but merely a means for making submicron technology ready for production. The overall megabit project, begun in 1984, has as its target date the end of 1988. At that time, submicron technology can be introduced for mass production at the chip factory in Nijmegen. Both Siemens and Philips believe that that date is feasible.

"The entire megabit project has to be divided into around a thousand steps," says Dr R. Hamersma, head of the integrated circuits division at Philips. "It is comparable to a jigsaw puzzle. About 40 percent of the pieces of the puzzle are now in place. The others will be found in the coming years. But if only one piece is missing, the puzzle is not complete."

Philips does not yet have access to one part of these steps; certain equipment is necessary for the production of megabit-chips that has itself only been partially developed. This equipment will be largely purchased, primarily in the United States, from firms that are producing it for the first time.



Beginning at the end of the 1980s, Philips will be applying submicron technology to all sorts of chips with complicated electronic circuitry, for personal consumer products such as televisions with improved picture quality, for example, or telecommunications, compact disc players and microprocessors. An electronics company is assured of a short life without increasingly advanced chips.

It is expected that the fruits of this first step in the submicron realm will be reaped for 6 to 8 years. In the meantime, Philips will continue with the miniaturization of chips, with even more circuits per square millimeter. By the turn of the century, another generation of chips will have to appear on the market with structures no larger than 0.2 micrometers. Philips has already achieved this degree of detail in the laboratory.

In preparing for the production of the next technological wave, Philips will, according to Van Houten, continue to work together with Siemens. Negotiations to that effect are under way. Van Houten feels that in view of the gigantic sums of money necessary for further development, cooperation with other European companies is also called for. The amount of money and the financial risks associated with it can no longer be borne by one company. Consideration is being given to Thomson, the French electronics company. Initial talks have been held.

The fact that individual companies in the coming years will no longer be able to have sufficient in-house expertise in every field to guarantee the further development of technology also plays a role in European cooperation.

12271

CSO: 3698/231

## WEST EUROPE/MICROELECTRONICS

### PHILIPS' NEW IC R&D CENTER: PROGRESS IN SUBMICRON TECHNOLOGY

Rijswijk PT/AKTUEEL in Dutch 10 Dec 86 p 8

[Article by Marjan van Hoorn: "European Cooperation for Future Submicron Project Work"]

[Text] Philips believes that future work on the submicron project will have to be carried out cooperatively within Europe. Developments in the world of IC's are moving at a tremendous pace. Making the effort necessary to keep up is extremely risky, because it calls for large amounts of money, and it only becomes apparent at a later stage whether all the projects are technically feasible and economically worthwhile. "That's why we mustn't try to do everything ourselves," said Dr S. van Houten, a member of the Philips Management Board, at the official opening of the IC R&D Centre on Tuesday of last week.

At present Philips is negotiating with German and French semiconductor companies on a joint project, the "Joint European Silicon Sub-micron Initiative" (JESSI), which would be part of the European Eureka Program. Van Houten further expects current cooperation with Siemens on the Megaproject to continue. The new IC center, which consists of a design center and a test factory, is part of the Megaproject. This is a joint Philips-Siemens effort to develop submicron technology to manufacture integrated circuits--the 1 megabit static RAM (Philips) and the 4 megabit dynamic RAM (Siemens). Using this technology, it is possible to manufacture chips with details measuring less than a micron (0.001 millimeter).

Constructing and outfitting the design and technology center has cost over 500 million guilders. Philips and Siemens are investing a total of 1.5 billion guilders in the Megaproject. The Netherlands and German governments have in principle declared themselves willing to allocate more than 500 million guilders to the project. Although the Netherlands government recently stated that it will no longer contribute to this kind of gigantic development project, Philips will nonetheless continue to ask the appropriate authorities for money. Van Houten: "We'll continue in the future to ask for support for the development of new generations of chips. The trend, however, is to do that more and more at the European level."

## Rapid Pace

By its own calculations, Philips is one of the 10 largest IC manufacturers in the world, and it wants at a minimum to maintain that position in the future. The rapid pace of innovation in IC technology makes it necessary to maintain a major, ongoing research and development effort. Only a limited number of firms will be able to keep up in this race, as Van Houten calls it, in the future. Up to now Philips has worked on integrated chips for numerous types of applications, but the company never gave much priority to MOS memories. "But the fierce competition in MOS memories has accelerated development in that area, and it's extremely important to be part of that. If Philips were not active in this field, it could in time fall behind," says Van Houten. Thus, the real goal of the submicron project is to develop the technology and design methods that will make it possible for Philips to continue to compete successfully in the late 1980's and early 1990's. The development of a 1 million bit static memory (SRAM) was chosen as the way to master submicron technology. Van Houten: "A SRAM like that isn't the easiest memory to manufacture, but it gives us the know-how we need to design all kinds of other complicated logical circuits."

Several generations of memory chips have come on to the market in recent years, and each successive generation has had four times the capacity of the previous one. At present 256 Kbit static memories are available, and Philips is going a generation further with the 1 megabit. The 1 megabit SRAM is a tremendously complex integrated circuit consisting of over 6,000,000 transistors.

## Encouraging Results

To produce this chip, it is necessary to considerably reduce the measurements of the separate transistors on it, with the smallest details measuring 0.7 micron. Dr K. Bulthuis, chairman of the Physics Laboratory, said in his speech that experiments with 0.7 micron technology have produced very encouraging results. "A few months ago an experimental 256 Kbit static RAM was produced using 1.2 micron silicon technology. The structures of this are comparable to those of a 1 megabit dynamic RAM. Although this first silicon was not perfect, important parts of the design have been tested and found to be good," Bulthuis said. The new test manufacturing line has started up with tested 2 micron technology on 6 inch wafers, and the first working circuits were turned out 2 months ago. Next, Philips will successively get 1.2 and 0.7 micron technology ready for actual manufacture. Philips recently installed the submicron stepper which prints patterns on wafers. Based on standard manufacturing methods, this can achieve line widths of less than 1 micron. Submicron technology with 0.7 micron details will not be the final word, however. In the laboratory Philips is already working on preparations to develop 0.5 and even 0.2 micron techniques.

## Mass Production

The first submicron circuits are to be ready toward the end of 1988, after which they will be provided to customers for testing. Work is underway in Nijmegen on a factory where it is planned to mass produce the new chips at the

end of the 1980's. According to Van Houten, there is less urgency about actual large-scale applications. This kind of technological innovation enjoys a window of at least 8 years in which to exploit the new developments. The submicron technology is expected to be in use from the end of the 1980's until late in the 1990's. "That's why Philips has to have this technology early and then gradually start to use it for an increasing variety of circuits, such as memories, and more specifically for microprocessors, televisions, compact disk equipment, and professional systems," Van Houten says.

12593

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## WEST EUROPE/MICROELECTRONICS

### SUCCESSFUL SEMICONDUCTOR RESEARCH AT CUSTOM DESIGN LUND LAB

Stockholm NY TEKNIK in Swedish 4 Jan 87 p 3

[Article by Anders Ingvarson]

[Text] "The Berzelius Laboratory makes it easier for us to conduct world-class semiconductor research."

This was stated by Professor Hermann Grimmeiss, the dynamic leader of semiconductor research in Lund.

The laboratory increases our ability to understand the properties of semiconductors.

At the 2 year old Berzelius Laboratory on Professorsgatan in Lund, research of international importance in the field of semiconductor technology is carried out at the basic research level.

The laboratory can also be seen as an indication that the government attaches great significance to the research in Lund.

The government invested 13 million to construct the laboratory at a time of cutbacks in other areas of research and gave the Department of Solid State Physics a free hand to design its laboratory for the production and analysis of semiconductor materials.

"The government authorities took their decision to its logical conclusion and gave us facilities that are suitable for our purposes. Today we have a tailor-made working environment for producing semiconductor materials."

"We have the conditions for continued work that is quite special in the international context. We can attract outstanding researchers," Prof Grimmeiss said as he showed us around.

"After a visit here, Nobel Prize winner Klitzing wanted a copy of the blueprints," the professor said.

## Flexible System

Simply stated, the Berzelius Institute consists of four walls with a service shaft in the middle to supply air and to create the proper environment.

It is specially built for the vibration and contamination sensitive equipment that is used.

Within these four walls, it is possible to construct new laboratories quickly for the production of semiconductors, for example.

One fourth of the surface is occupied by clean rooms that are used primarily to search for new semiconductor materials.

A computer controlled system called MOCVD (metal organic chemical vapor deposition) is used to create these materials.

## Alternatives To Silicon

Today the research is concentrating on materials that are compounds containing elements from group III and group V in the periodic system. They include gallium, indium, arsenic, and antimony.

Gallium arsenide, the semiconductor material that is presently seen as the most important competitor to silicon, is one such compound.

"This research is primarily of interest in the context of international semiconductor research, but we also know that it is only a short step from basic research to practical applications in new electronic products," Hermann Grimmeiss said. "It is believed that the research we are conducting right now will lead to major breakthroughs in information technology, especially in fiber optics."

"Among other things, our investigations have made it possible to produce lasers that are much faster and more stable than in the past."

"But our laboratory is most important for international research. Our work results in a greater understanding of the structure and properties of semiconductors. Specific applications result from this increased understanding," said Prof Grimmeiss, who stressed the importance of outstanding basic research in this country.

## Deep Levels

The Department of Solid State Physics in Lund is concentrating its research on the study of "deep levels of interference" and "point defects in semiconductors."

By studying the deep levels, researchers can obtain an extremely precise picture of a compound's properties. This also makes it possible to determine what materials are best suited to a certain application.

The purpose of studying point defects in semiconductors is to produce materials with as few impurities as possible. This will result in a greater number of fault-free components in production.

"This is where we have done our most exciting work in recent years," Hermann Grimmeiss said. "Among other things, we have studied changes in optical effects that occur when we compress semiconductor crystals and reduce the distance between atoms."

#### Identifying Atoms

A device for measuring electron spin resonance was recently installed. It is used to identify foreign atoms in semiconductors.

Researchers can study with greater and greater accuracy the types of atoms that cause impurities in semiconductor materials.

"The Berzelius Laboratory has made it easier for us to study the phenomena of semiconductor physics," the Lund researcher said.

#### Industry Soaking Up

Even though this is high-level basic research, the laboratory has close ties to industry.

This is also confirmed by the steady stream of doctoral candidates from the Berzelius Laboratory to the industry.

"The fact that our doctoral candidates move on may be seen as a problem, but the constant turnover also has its good sides. We train researchers in a short time and we can provide the industry with highly qualified people."

#### Bright Future

Hermann Grimmeiss has built semiconductor research in Lund from the ground up. With the Berzelius Institute, he is now looking forward to a bright future.

Conditions in Sweden have never been better, he said as he walked away with a West German researcher who is interested in coming to work in Lund.

9336

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## WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### CNRS OF FRANCE SEEKS BETTER RESOURCE MANAGEMENT

Paris LE MONDE in French 7 Jan 87 p 11

[Article by Jean-Francois Augereau and Franck Nouchi: "CNRS Wants More Control Over Its Researchers"; first paragraph is LE MONDE introduction]

[Text] Medical and biological research circles are greatly agitated. The reason for this is the receipt by researchers of two letters, one from the director of CNRS [National Scientific Research Center], the other from the management of INSERM [National Institute of Health and Medical Research], aimed at "permitting rational management of personnel while encouraging their mobility."

The management of CNRS would like to take stock of its researchers who work in INSERM units, to find out how many desire to work there permanently and how many would agree to "return to the fold." CNRS researchers working at INSERM and those from INSERM working at CNRS are asked to choose between two solutions: availability to their own organization or severance with a view to subsequent integration in the host organization.

These letters, sent in the latter half of last December, instructed the researchers to put their administrative situation in order before December 31, 1986. A total of 229 CNRS researchers working in INSERM laboratories would be affected by this document, considerably fewer from INSERM.

With a large number of advanced research teams attached to INSERM for medical and biological research, certain unit directors fear that ultimately 80 percent of the CNRS researchers working at INSERM will ask for permanent integration there.

INSERM's budget could not absorb this additional burden without using the bulk of its funds earmarked for hiring young researchers or creating new units. This, in turn, would threaten the infusion of new blood into the body of research personnel.

For the moment, engineers, technicians, and administrators (ITA) would not be affected by these administrative decisions, but, according to the unions, CNRS has asked them not to apply for the INSERM units being created. As for the young researchers who are considering joining these two organizations, these



measures do not affect them since CNRS and INSERM have mutually agreed to continue reciprocal recruitments in 1986 and 1987. From this we can deduce that the situation will change as of 1988.

#### No Ulterior Motives

When questioned about this directive the CNRS declared that it had no ulterior motives, stating that these letters had been sent in order to adjust the association between the two organizations, which, according to the general manager of CNRS, must occur "on a healthier and sounder basis." It is clear that the goal of CNRS general management is to use such scrutiny to determine which research units should be strengthened.

Under these circumstances there is every reason to believe that it will also examine certain other units that it thinks are insufficiently productive. But it must also avoid "damaging the careers of CNRS researchers working in INSERM units whose research functions are unrelated to CNRS."

Those at INSERM find the excessively rigid attitude of CNRS during the negotiations at the end of December regrettable, and say "that is not the way a research organization like CNRS will distinguish itself for the value of its scientific policy."

Some research unit directors go even further by wondering if behind these apparently purely administrative measures there is not a "hegemonistic and imperialist intent" of the CNRS life sciences department to reshuffle this very profitable research sector to its own advantage.

"Until now, the free interpenetration between the two organizations has been the strength of our medical and biological research," comments Prof Claude Kordon, one of some thirty managers of the INSERM research units employed by CNRS. "It would really be a pity to throw such a wrench into the works at this point."

13233

CSO: 3698/249

## WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### CNRS OF FRANCE APPOINTS EXECUTIVE COMMITTEE

Paris LE MONDE in French 22 Jan 87 p 11

[Article by E.G.: "CNRS General Manager Appoints Executive Committee"; first paragraph is LE MONDE introduction]

[Text] The reform of the National Center for Scientific Research (CNRS), initiated by the former minister in charge of research Alain Devaquet, has been marking time because of the vacation of the Rue Descartes authorities. However, the new general management structures should be installed in the very near future.

In a recent letter to the upper management of the institution, CNRS general manager Serge Feneuille announced "the establishment of an executive committee" to aid him "in all his duties." He identified the members of this committee as Jacques Demaille, Jacques Lautman, Jean-Claude Lehmann, scientific managers; Philippe Didier, secretary general; Gilbert Morvan, personnel and business manager; and Laurence Paye, assistant to the general manager.

Although all these individuals are already on the general manager's staff, in practice this new organization should bring about some changes.

Previously, the CNRS actually had as many departments--each directed by a scientific manager--as it had research disciplines. Moreover, there used to be three "horizontal managements" devoted to development, communications, and international relations. Henceforth this structure will be streamlined. Of course, Demaille, Lautman, and Lehmann remain in charge of the departments they formerly headed--life sciences, human and social sciences, and theoretical mathematics and physics, respectively--but "they will delegate a portion of their responsibilities to one or more assistant scientific managers." In addition, they will be given new functions: First, "the development of a strategic plan", second, "an internal and external communications policy," and third, "international relations and programming of large-scale computers."

The final step in this plan of action called for the appointment of a fourth scientific manager. This will only be possible with the consent and signature of the minister of research. Also as yet undetermined is who will handle CNRS

relations with businesses. This reorganization, however, is already raising some concerns with certain researchers contending that this executive committee, responsible for advising the general manager in defining organization policy, "has as many administrators as it has scientists."

Be that as it may, the entire CNRS reform as envisioned by Devaquet is rejected by the major unions of research personnel (affiliated with the CFDT, CGT, FEN, and FO), which demand its withdrawal. For this reason, but also because they desire "real negotiations on the future of the organization to be opened" and wish to obtain "the resources and jobs necessary for CNRS development," these unions are calling for work stoppages and demonstrations at the headquarters of the institution on Thursday, 22 January.

13233

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## WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### NORWEGIAN FIRMS TO PARTICIPATE IN EUREKA SOFTWARE FACTORY

Oslo AFTENPOSTEN in Norwegian 15 Jan 87 p 44

[Article by Georg Parmann: "Norwegian Computer Technology Made Part of Europe"]

[Text] Norwegian computer technology can be on the eve of its real international breakthrough after Norsk Data and the Center for Industrial Research (SI) have been admitted as members in a project aimed at common European guidelines and standards for the development of computer systems.

Eureka Software Factory, as the project is called, has a current budget of 2.4 billion kroner up to 1994 and is one of the largest research and development projects in the European Eureka joint venture.

"As it is today, with a jumble of computer systems, it is difficult to achieve European interplay," Eirik Naess-Ulseth, the man responsible for the project at SI, says to AFTENPOSTEN. "This has given American and Japanese solutions a free hand in the European market. The purpose of the project, in other words, is to meet the challenge from giants like IBM and Digital," Naess-Ulseth says.

#### New Market

If Europe can agree on common guidelines and standards, the enormous European market will lie open. Everyone participating in the Eureka program will be in a good position in the fight for market shares in this "new market."

"Eureka Software Factory is an industrial project with distinct commercial goals, where industry itself is paying for considerable portions of the research effort. On Norway's part, participation means a unique chance both to strengthen Norwegian computer technology and to enter the European market with our products in all their breadth," Naess-Ulseth says.

[Question] Why did the Center for Industrial Research join the Eureka program?

[Answer] "In the European context we are a small industry-oriented research institute, but we have been able to show the competence SI has developed in

computer technology. We are the world leader in one subfield, 'object-oriented systems development,' and this gave us a foothold."

[Question] What is "object-oriented systems development?"

[Answer] "Our idea is that new and old computer equipment should be able to be used in place of one another, a thing we have accomplished in a very user-friendly way," Naess-Ulseth says. Until now it has been the rule that computer equipment has to be replaced when new and better systems come on the market."

The Norwegian Task Master firm has just started on the basis of SI's object-oriented systems development and will internationally market its first product in the course of the year.

Naess-Ulseth says that Norsk Data's products will also become more attractive through participation in Eureka, and that new market opportunities will open up for the internationally respected Norwegian computer company.

SI's research and development through the entire Eureka-project period has been publicly supported through the Norwegian Council for Scientific and Industrial Research. The program has cost 30 million kroner up to now and is being led by Jan Fredrik Mack at SI.

8831

CSO: 3698/238

## WEST EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

### BRIEFS

NETHERLANDS LOSING INTEREST IN BRITE--Amsterdam--There is still little interest in the EEC's BRITE [Basic Research in Industrial Technologies for Europe] program among the Netherlands business community. A provisional stocktaking shows that the Netherlands is lagging in bringing forward project proposals. The Ministry of Economic Affairs is trying to make up for lost time. In 1985 the EC launched a research and development program in basic technological research and the implementation of new technologies. The BRITE program provides 50-percent financial support to projects of companies specializing in the development of new manufacturing techniques, including CAD/CAM techniques for industrial processes and flexible production systems for small- and medium-sized businesses. The subsidy scheme is intended to boost Europe's competitive position as compared with the United States and Japan. A provisional assessment shows that few applications for subsidy have been submitted by Netherlands companies. One possible cause could be that collaboration between at least two businesses belonging to two EEC member-states is required to qualify for participation in BRITE. For that reason the EEC Liaison Bureau ([telephone] 070-451600) has been instructed to act as an intermediary for establishing contacts in other member-states. [Signed C.D.Z.] [Text] [Amsterdam COMPUTERWORLD in Dutch 6 Jan 87 p 38] 25059/9312

CSO: 3698/A104

## WEST EUROPE/TECHNOLOGY TRANSFER

### BRIEFS

FIAT EQUIPMENT TO POLAND--The Italian Interministerial Committee for the Coordination of Industrial Policy [CIPI] on 20 November 1986 approved the sale of Fiat automobile production equipment to Poland. The Fiat-Polish agreement, known as Fiat-Pol/Mot, calls for the Italian company to supply machinery and equipment worth 2.35 trillion lire for two auto production plants in Poland. The agreement also covers the importation of motor vehicles from Poland worth 2 trillion lire through the year 2000. According to CIPI, the supply of Fiat equipment to the Polish Pol/Mot association is in line with the policy of defending and increasing the position of the Italian automobile industry on the European market. [Summary] [Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian 2 Jan 87 p 21] 8627

CSO: 3698/M129

## EAST EUROPE/MICROELECTRONICS

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#### On Our Cover

On our cover one can see the optical keyboard of the Datacoop Small Cooperative. This product, already in series manufacture, is a "part" for computer manufacturers which up to now could be regarded as a shortage item. The aim of Datacoop was to make a keyboard, at an acceptable price, which was also suitable for professional equipment. Keyboards containing Hall generator or other special switching elements are expensive and membrane keyboards do not meet the reliability requirements. Interrupting the light paths arranged in a matrix can be regarded as switching; electric signals result just as if we had used a mechanical switch (on or off).

They only needed to find a suitable execution for the patented principle in order to get a product which could be manufactured in series. Gabor Eszes, chief of manufacturing, describes the design of the optical keyboard.

#### Devices

Our devices column contains two articles, the article on the optical keyboard and an article by Laszlo Bansagi titled "UNIPORT Interface".

#### Systems

In our systems column we begin a description of telematic services. Teletex is already a reality in Hungary; videotex and teletext will be in the near future. The common characteristic of these services is that they make combined use of the possibilities of telecommunications and computer technology in the interest of information transmission. Jeno Berkes describes the teletex systems; this is the first in our series. This will be followed by a description of videotex and facsimile services.

Also in this column is an article by Ferenc Kereszty and colleagues on "systems for processing seismic data." This is the second in a series by Kereszty and his colleagues on seismic data processing. The processing system,

based on the R-11 computer, can be used for both continental and oceanic oil prospecting.

#### Hobbytronics

In our hobbytronics column we publish the first half of a program to modify the C-64 character generator; because of its size we could not publish it in one part. Even now we call the attention of our critical readers to the fact that the program is Istvan Toth's own work; it is not a program taken over or a foreign program deliberately changed. Your observations--negative or positive--should be sent to our editors. (Address and telephone number are on page 1.) One can submit programs or hardware ideas; if we do not use them we will send them back so you may put them in other journals.

#### Focus

We rarely comment on our focus column, perhaps never here in the description of contents. The popularity index of this column is perhaps the greatest, because everyone finds useful information in it. If this really is true then we editors have achieved our goal. We try to select from a broad circle and to publish as soon as possible news about technical novelties judged more significant. (The throughput time is about 3 months; the news items were fresh only at the time of selection. This delay--we think--will still not hold back our technical development.)

#### Advertisements, Product Descriptions

Advertisements and product descriptions constitute an important part of our journal, although a few of our readers objected, in the course of a survey, that there are too many advertisements. In our opinion advertisements have two functions--to provide information about new products or services and to help support our journal. We never made any secret of the fact that the publication cannot be kept in economic balance from the sales receipts, and we do not think that is a disgrace. (In the case of Western journals it is simply natural that they live from advertising.) The advertising income makes it possible for us to pay our authors a relatively respectable honorarium and to put out the journal in acceptable form. We ask our readers to understand this and support our efforts.

8984

CSO: 2502/18

HUNGARIANS MANUFACTURE OPTICAL KEYBOARD

Budapest MAGYAR ELEKTRONIKA in Hungarian No 5, 1986 pp 10-13

[Article by Gabor Eszes: "The DCD-OT-327 Keyboard"]

[Text] The keyboard, operating on a new optical principle, is--considering its design--a highly reliable professional device which can be adapted to optional computer technology equipment.

Introduction

When studying computer technology devices and systems it is generally the central unit which gets into the spotlight. But this attitude, understandable from many viewpoints, can have the unfortunate consequence (especially in the case of restricted resources) that insufficient energy goes to the production of supplementary equipment (keyboards, printers and background stores). But one must not forget that even the weakest link determines the quality, reliability and even esthetic appearance of the combined system and as a result great care should also be turned to the above mentioned components. Recognizing this the Datacoop Computer Technology Small Cooperative developed and has begun to manufacture the OT-327 model professional keyboard.

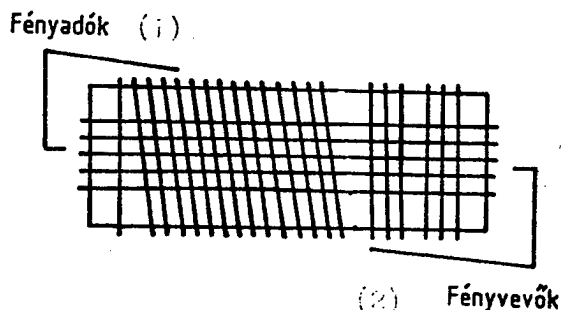
The keyboard is an important tool for communication with a computer, for putting in information. It is part of even the simplest home computers, but naturally the technical and reliability requirements are much greater for professional personal computers and higher categories and for data entry stations connected to such machines. The DCD-OT-327 keyboard had to satisfy the needs of this quality category. In practice the various computers and data entry stations all require different, unique keyboards, so when designing more serious equipment, in an understandable way, one given keyboard cannot be the starting point. Other requirements are made of the number of keys, their inscription and function and electrical characteristics in connection with the data transmission system. So the goal was the development of a universal, highly reliable professional keyboard which could be changed flexibly in the course of manufacture according to custom ideas, which would fit optional systems appearing in practice and which could be produced at a realistic price.

### Operating Principle and Structural Design of the Keyboard

Capacitive sensing or conducting rubber membrane contact keyboards could not be considered because of the unreliability of their operation, their sensitivity to environmental effects and their limited life expectancy. Electromechanical contact keyboards meeting modern requirements can be produced today by using special technologies and materials, but under domestic conditions this did not seem a path which could be followed. The elements needed to make Hall generator devices can be obtained only from import in addition to which such devices are most complex and expensive and their energy need is rather large too.

The OT-327 keyboard operates in a new way, on an optical principle. Phototransistors which transmit or sense infrared light are arranged in rows and columns opposite one another to form a matrix so that a network of light paths is created (Figure 1). The keys are at the crossing points of the light paths so that when a key is pressed the path of light is broken in one row and one column of the light matrix. The corresponding electronics sense this; the key pressed can be identified from the position of the given row and column, and then the appropriate code can be transmitted.

Figure 1.



Key:

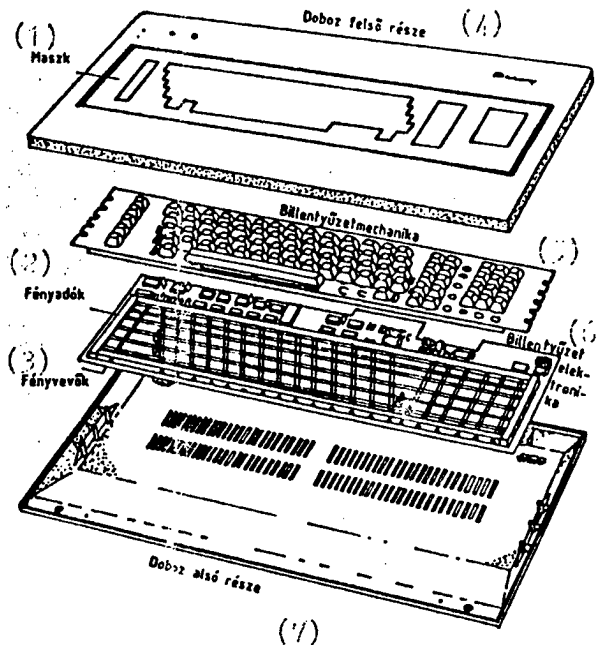
1. Light transmitters
2. Light receivers

The great advantage of the principle used is that the mechanics of the keyboard (usually one of the greatest sources of error) are extraordinarily simple; in the final analysis this is the key to great reliability. Unlike the usual electromechanical contact or Hall generator solutions the mechanics are completely independent, even physically, of the electronics, which is accompanied by easily seen advantages from the viewpoint of manufacture and servicing.

The structural design of the keyboard can be seen in Figure 2. The light matrix and control electronics are placed on a common printed circuit panel; this unit is fixed to the mechanics by screws. The case for the device is made

of shock resistant antistatic plastic in a self-supporting fashion; it can be well adapted esthetically to other computer technology equipment. A cable led directly from the printed circuit panel provides the electric connection for the device; this cable is fitted with an adapter according to the desire of the customer.

Figure 2. Structural design.



#### Key:

- |                       |                         |
|-----------------------|-------------------------|
| 1. Mask               | 5. Keyboard mechanics   |
| 2. Light transmitters | 6. Keyboard electronics |
| 3. Light receivers    | 7. Lower part of case   |
| 4. Upper part of case |                         |

#### Structure of the Mechanics

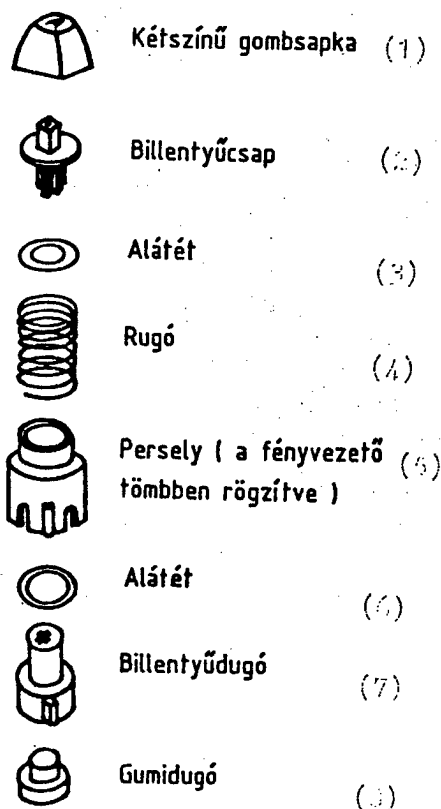
The mechanics of the keyboard consist of three main parts--the light conducting block, the keys which can be snapped into it and a perforated stiffening panel which provides mechanical strength.

In addition to supporting the keys the task of the light conducting block, made of molded plastic, is to isolate the light paths from one another and from light coming from the environment. Accordingly it contains semicircular cross section tunnels laid out according to the given keyboard arrangement (see Figure 1); the printed circuit board seals these from below after they are screwed together. Plastic slats, provided with appropriate cutouts, on the panel guide the light transmitting and receiving elements. When assembling the light conducting block it is fitted tightly to these supporting elements so finally the light paths are isolated from the environment in every direction.

There are holes in the light conducting block at the crossing points of the light paths; the assembled keys must be snapped into these. In the present design one can use 96 key locations, arranged according to Figure 1. If the user needs fewer keys than this the remaining holes can be sealed with appropriate plastic elements. There is a mask sheet in the upper part of the case of the keyboard; the cutouts in this are formed during molding according to the key positions actually used.

The structure of the individual keys can be seen in Figure 3.

Figure 3. Structure of one key module.



Key:

- |                  |                                              |
|------------------|----------------------------------------------|
| 1. Two color cap | 5. Bushing (fixed in light conducting block) |
| 2. Key plug      | 6. Washer                                    |
| 3. Washer        | 7. Key plug                                  |
| 4. Spring        | 8. Rubber plug                               |

The assembled key is attached in the light conducting block with a guide plug and a bushing supplied with cutouts corresponding to the light paths. The plug which closes the light path moves (against a spring) in this bushing; with the aid of the key plug one can attach changeable caps to this plug. The rubber at the bottom of the plug makes the striking of the plug against the panel as noiseless as possible. The washers, made of flexible rubber, also serve to

dampen the noise of striking. The "space" key, eight modules wide, appears to be a different design, because it also contains a guide stirrup to prevent horizontal or vertical deviation. It was thus possible to satisfy the requirement that the wide key could be depressed by touching any part of it.

The caps are molded in two colors. The inscription can be formed when the first color is molded, with the aid of an exchangeable insert in the tool (so there is no need for engraving or for unreliable screen printing). Any inscription can be prepared easily with this method; for example, the manufacture of Cyrillic letter keyboards caused no problems.

In the interest of guiding the light paths precisely and sealing them from the environment the light conducting block, which is made of plastic and is of large size and thus could be deformed, is stiffened by a metal sheet with perforations corresponding to the key positions.

#### Structure of the Electronics

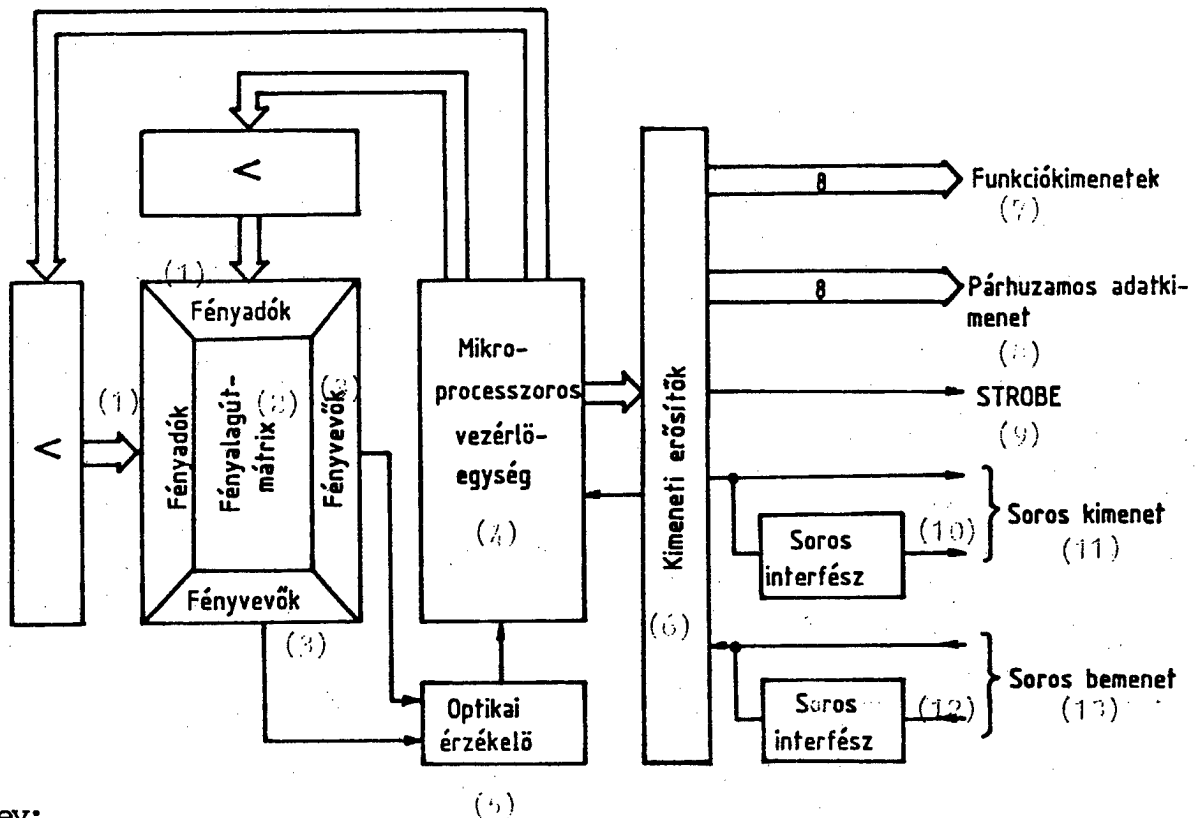
All the electronics of the keyboard, including the infrared light matrix, are placed on a single printed circuit panel mounted beneath the mechanics. The chief feature is Z80 based microprocessor control. The control program and the table of codes belonging to individual keys or key combinations can be found in one 16 K bit EPROM. Thanks to this organization--as we shall see--user needs can be satisfied very flexibly over a broad range.

A block diagram of the system can be seen in Figure 4. Let us look at what is happening in a little more detail! The address decoder after the microprocessor selects what follows in the given phase--control of the light matrix, issuing codes or, as an optional possibility, issuing other TTL level signals. The light matrix is driven in a time multiplex manner; only one LED can light at once (this is very necessary in order to reduce power consumption). The common outputs of the light sensing phototransistors belonging to rows or columns in accordance with the keyboard arrangement are connected to one each comparator. If a light path is interrupted by pressing a key then the voltage increases in the light sensors, and the comparator transforms this into a TTL level signal.

The light matrix is polled on the basis of this as follows. First the microprocessor checks only the rows. If the pressing of a key is sensed here then the columns are polled. The output of the comparators indicating the pressing of a key are common, but the microprocessor knows which row or column it checked at what time and so can identify the key pressed. Then, as long as the pressing persists, the system checks only the row and column belonging to the given key. If this time is longer than approximately one second then the automatic code repetition (typamatic) function begins with the issuing of a 10 Hz data validation signal. Protection against pressing two keys simultaneously is also built into the system by software means; if, during one whole polling cycle, the light is interrupted in more than one row or column then the keyboard does not issue the data validation signal (for it cannot know which of the two keys pressed at once is the right one). But the situation is different if the two keys are not pressed at once (within the time corresponding to one polling cycle); as long as it is pressed the system

drives only the row and column of the key pressed first; it takes note of the second key only after releasing the first (two-key roll-over function).

Figure 4. Block diagram



Key:

- |                                |                         |
|--------------------------------|-------------------------|
| 1. Light transmitters          | 8. Parallel data output |
| 2. Light tunnel matrix         | 9. STROBE               |
| 3. Light receivers             | 10. Serial interface    |
| 4. Microprocessor control unit | 11. Serial output       |
| 5. Optical sensor              | 12. Serial interface    |
| 6. Output amplifiers           | 13. Serial input        |
| 7. Function outputs            |                         |

Because of the protection against double pressing the function changing keys (SHIFT, CONTROL, etc.) have to be handled a little differently, for it is their task to change the output code when they are pressed at the same time. For this reason there is a unique optocoupling element for such a key; if the press sensing signal comes from here then the normal polling of lines and columns continues in the above described manner.

So we have seen how the pressed key (or even function changing key) is identified. On the basis of this the microprocessor computes an address with which it selects the corresponding element of the code table stored in the EPROM. The outgoing code is issued via the output stores selected by the previously mentioned address decoder, together with the data validation



signal. There is also an input bus drive on the data bus of the microprocessor; for example, it receives the press sensing signal via this. But one can also select here the serial or parallel output mode; if the appropriate input is tied to the logical null level during manufacture the output will be serial, otherwise it will be parallel. There is also a test program in EPROM to facilitate start-up and testing of the electronics and error detection. This can also be initiated with an external control signal. Naturally the processing of other external control signals can also be solved as the customer desires.

Line driving interfaces (V24, 20 mA current loop, etc.) can be mounted in the printed circuit at prefabricated locations as desired.

#### Further Development Plans

--By using a light conducting block made of modules it would be possible to make even more varied keyboard arrangements (e.g., one compatible with the IBM PC, six lines of keys, etc.).

--We could use larger keys (two modules wide) for the ENTER and SHIFT functions.

--If a need for it arises the space occupied by the keyboard could be reduced.

#### Autobiographic Note, Gabor Eszes

I graduated in 1971 from the Kalman Kando Technical College and then worked until 1977 at United Incandescent in semiconductor manufacture. In the meantime I got a degree in physics at the Lorand Eotvos Science University and transferred to the KFKI [Central Physics Research Institute] where I dealt with basic research. Since 1984 I have been with Datacoop where my task is leadership of manufacture in our Diosd plant.

Everything interests me. In addition to organizing and controlling technological processes I deal with educating children, surfing and sailing. I like to read till dawn (even professional literature sometimes!). I am satisfied with myself only if my work is going well and if there is time for "other things" and there are no problems with it. This happens only very, very rarely....

8984

CSO: 2502/18

HUNGARIANS DEVELOP DATA MANAGEMENT SYSTEM FOR COMMODORE-64

Budapest MAGYAR ELEKTRONIKA in Hungarian No 5, 1986 pp 14-20

[Article by Laszlo Bansaghi: "UNIPOINT, A Universal Signal and Data Management System for the Commodore-64 Microcomputer"]

[Text] Introduction

The range and broad use of the C 64 microcomputer are well known. But a significant number of the applications are of an expressly computational, business or possibly graphic character. There are relatively few applications where the microcomputer would have a direct, real time connection with other hardware devices although--contrary to the technical general belief--it is suitable for this in a far reaching way considering its characteristics.

There are probably two reasons for the neglect. On the one hand a large number of the microcomputer owners stick to traditional applications in their awareness of the possibilities of the machine, for the "dispersion" of computer technology culture has just begun.

On the other hand, if the user needs to use the microcomputer in measurement, control, etc. systems (and this need is appearing more and more) there is no electronic coupling element which makes the microcomputer suitable for direct reception or transmission of various electric signals.

Recognizing the above and after estimating the applications needs to be expected we at the mathematics faculty of the Electrical School of the Budapest Technical University began to develop a universal coupling and signal transforming system:

--which would be suitable for sending and receiving analog and digital electric signals with acceptable operating speed and precision,

--the operation of which would be simple for beginners or those not expert in computer technology, and

--which would be relatively cheap.

We describe below the UNIPOINT signal and data management system born as a compromise of these partly contradictory viewpoints.

## Structure of UNIPORT

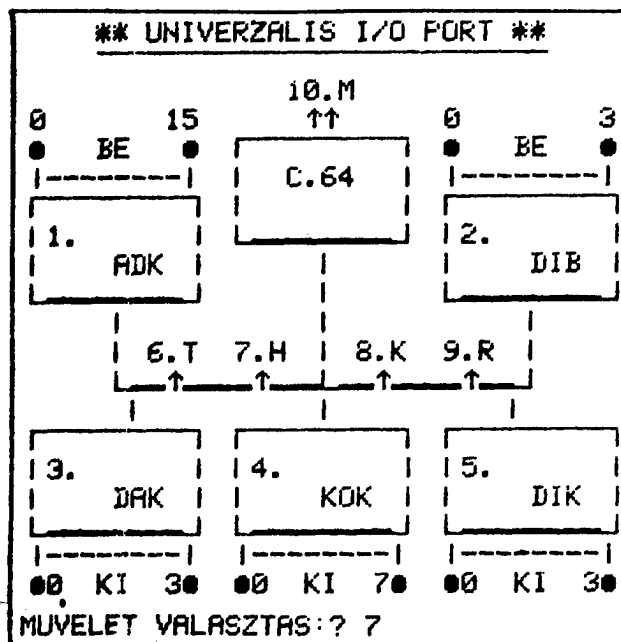
Deviating from what is customary--and adapting to the view of users--we begin the description by describing the services of the system, only then will we turn to a theoretical and practical description of the internal structure of the equipment.

The first three figures show photographs of the front and back view of the UNIPORT and a UNIPORT connected system with microcomputer and floppy disk drive.

In Figure 1 one can also see the expansion connector of the microcomputer with the adapter we attach to the flat cable. The signal transmitting or signal receiving peripherals are connected through the plugs on the back which can be seen in Figure 2.

If we load the management programs into the microcomputer from disk then the interface appears on the screen as the diagram which can be seen in Figure 4.

Figure 4.



["Muvelet valasztas?" means "Operation selection?".]

The two upper blocks (1 and 2) symbolize input operations, the three lower blocks (3, 4 and 5) symbolize output operations. The letters refer to the character of the operation, as follows:

1. ADK--reception and A/D transformation of analog signals.
2. DIB--management of digital inputs.
3. DAK--digital/analog transformation, transmission of analog signals.
4. KOK--management of control outputs.
5. DIK--digital output management.

Auxiliary operations are:

6. T--memory check,
7. H--hard-copy,
8. K--exit from operation,
9. R--general operation stop (reset), and
10. M--data save to disk.

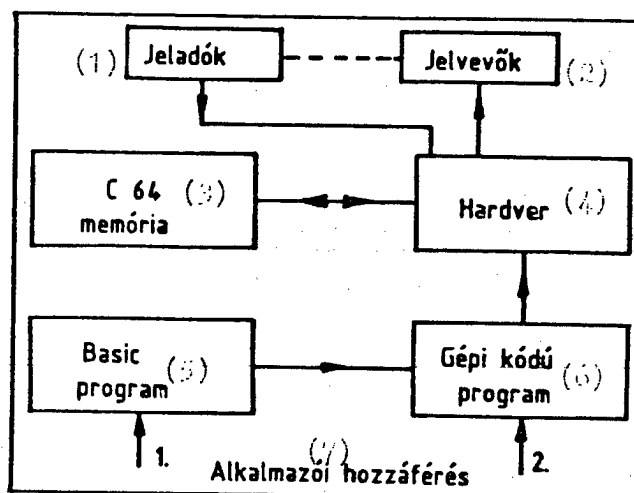
If to the query on the screen in Figure 4, "Operation selection?", we give the number of the desired operation then questions pertaining to characteristics of the selected operation appear on the screen. We will return to this later.

For every input function the source of the signal or data is external user equipment, a target station or a free memory compartment of the microcomputer. In the case of an analog input signal the binary value of the signal at the given moment is given after A/D transformation while in the case of a digital signal its binary value is given directly.

In the case of an output operation the signal source is always the memory of the microcomputer or one of its operating registers, and the receiver can be one of the connected peripherals.

Before we describe the several functions in more detail we should speak briefly of the program which operates the UNIPORT. This consists of two parts, one BASIC and one machine code program package. Figure 5 shows their linkages to each other and to the hardware part.

Figure 5.



Key:

- |                        |                         |
|------------------------|-------------------------|
| 1. Signal transmitters | 5. BASIC program        |
| 2. Signal receivers    | 6. Machine code program |
| 3. C-64 memory         | 7. User access          |
| 4. Hardware            |                         |

In the interest of greater speed the machine code program always operates the circuits. The task of the BASIC program, "connected in front," is to facilitate the setting of the several operations by the user, provide the desired operating characteristics, and to interpret these for the machine code program and put them into its work registers.

As can be seen in Figure 5, the user also has direct access to the machine code program. If the initial data needed for operation are given from his own applications program he can call up, as subroutines, the machine code parts handling the several services. In this case there is no need for the BASIC program, so it need not be loaded into the machine. This frees about 10 K bytes of memory.

Now let us examine the several basic operating modes in the order of the designations and serial numbers in Figure 4.

#### Signal Receiving Operations

##### 1. Reception and A/D Transformation of Analog Signals (ADK)

Here the UNIPORT can receive analog signals in the range between 0 and 5 volts on a maximum of 16 channels. It samples these in the time multiplex mode, transforms them with an 8 bit resolution (in the decimal number range between 0 and 255) and puts the samples in a free memory area of the microcomputer.

In the case of internal timing the frequency of sampling can be set to values --for one channel--from 7,000 samples per second to one sample per 3,000 seconds in steps of one microsecond up to 50 ms and in steps of 50 ms above that. The screen of the BASIC program which sets a timed, multichannel mode can be seen in Figure 6.

Figure 6. [Translation of screen.]

```

** ADK TIMED **
-----
NUMBER (1-16) OF ANALOG CHANNELS SAMPLED....? 5
SEQUENCE, (CHANNEL NUMBERS 0-15)

> 3 > 1 > 0 > 4 > 12

NUMBER OF SAMPLING CYCLES (1-5419)....? 1500
TIME BETWEEN (.66 MSEC-3000 SEC)....? 1 MSEC
INITIAL ADDRESS OF SAMPLE LOCATIONS....? 14264
HARD-COPY (Y/N)? N
OPERATING MODE (A/B)....? A

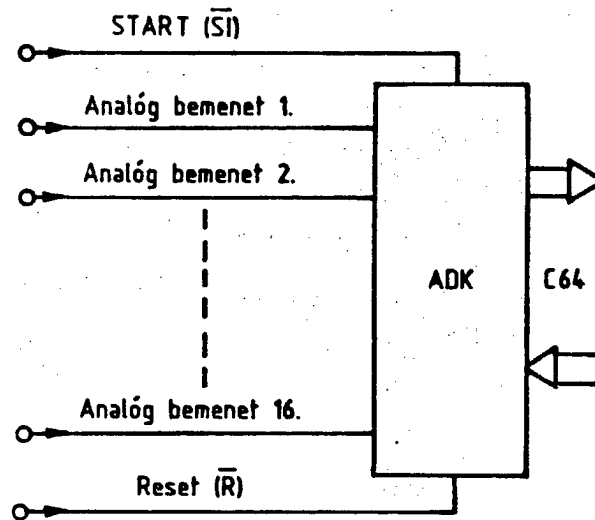
I AM WAITING FOR START !

GOTO 440
```

Sampling can be started from the keyboard or with an external electric signal. The latter makes it possible to synchronize the start of sampling to external

equipment. The sampling sequence of the channels can be optional. Figure 7 shows a block diagram of the ADK with the connecting signal lines.

Figure 7.



[The lines are labeled START, analog inputs 1-16 and Reset.]

## 2. Digital Input Management (DIB)

In this mode the machine can receive TTL level digital signals on four--8 bit--channels and can store their binary values in the determined part of the memory of the microcomputer.

Data input can be with microcomputer pacing or with an interrupt initiated by the peripherals, in the handshaking mode.

In the case of microcomputer pacing one can have timed or addressed operation under conditions entirely similar to ADK operation. Here also the channel sequence is optional and start can be manual or automatic.

If data input takes place at a peripheral interrupt request the authorized peripheral can request interrupt and data transmission with an electric signal, but here also it is possible for the microcomputer to influence the peripheral with one bit on a separate line. Figure 8 shows one of the possible screens for the interrupt operating mode. In Figure 9 one can see that every digital channel has eight data lines, a "data requested" (AK), a "data received" (AV) and an "interrupt input" (MB) line. These can fit on the back connector of the UNIPORT.

Figure 8. [Translation of screen.]

DIB

PERIPHERAL OR MICROCOMPUTER

---

INITIATION, WITH HANDSHAKING.

FREE MEMORY AREA: 14030-40967  
 SAMPLED CHANNEL NUMBER (1-4):? 4  
 MEMORY AREAS BELONGING TO THE CHANNELS

0	14031-20764
1	20765-27498
2	27499-34232
3	34233-40966

INTERRUPT AUTHORIZED !

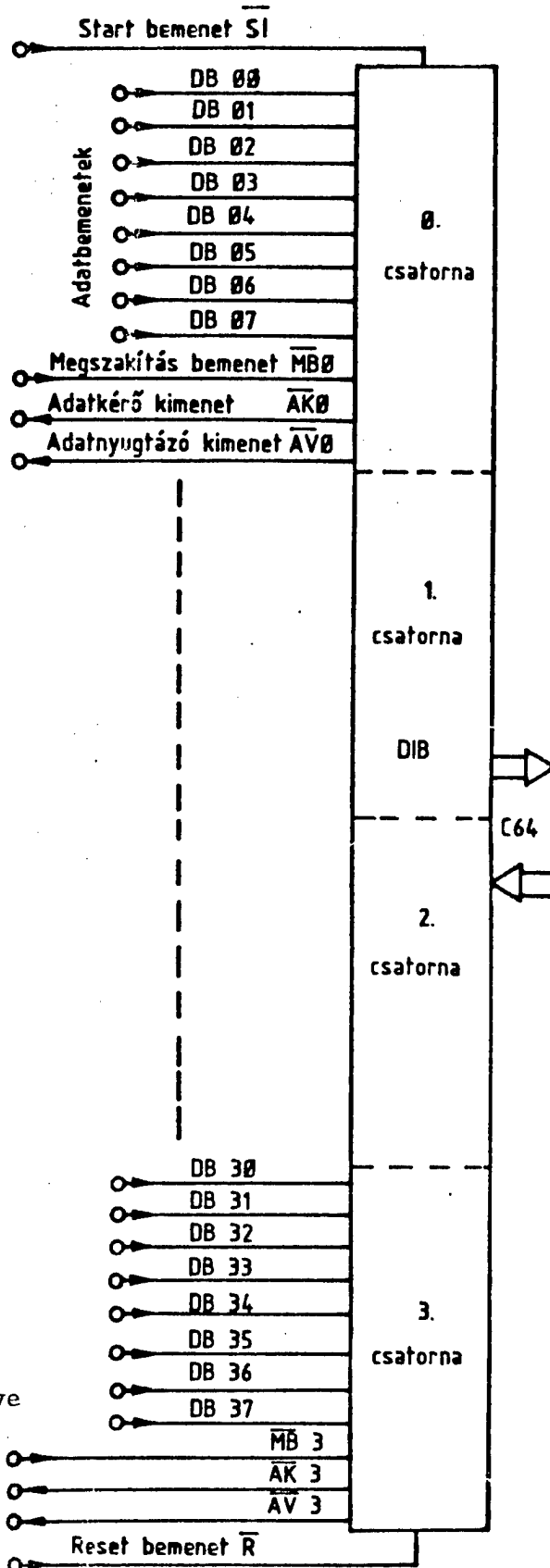
COMMAND FOR COMPUTER START:

POKE (56860+CHANNEL ADDRESS),0

GOTO677

[Four channels (0-3) are shown  
 in Figure 9; the paragraph above  
 explains the symbols]

Figure 9.



### Signal Transmission Operations

#### 3. Management of Analog Outputs, D/A Transformation (DAK)

With its use analog signals can be produced on four independent channels. If we give to the desired channel data from the computer with a decimal value between 0 and 255 then a voltage between 0 and +5 volts of a size proportional to the value of the data appears on the output of the channel. Since the UNIPORT maintains the output voltage between two transformations one can obtain a trickling analog step function at the output corresponding to an optional data series--produced in the computer--which is sent to the channel.

Naturally in addition to this signal generation function--which can be used in many ways--one can also restore the original analog signal, for example, from the data series collected by earlier sampling of an analog signal. (The "restoration" also has a step function form since the UNIPORT does not contain an output filter.)

For this purpose the BASIC program has a special service, a "repeat mode," on the DAK 0 channel. With this one can "analogize" with periodic repetition of an optional part of the C 64 memory, and the signal received can be displayed on, for example, the screen of an oscilloscope.

Figure 10. [Translation of screen.]

```
DAK

** ADDRESSED MODE **
-----

CHANNEL NUMBER (0-3).....? 3

DECIMAL DATA (0-255).....? 222

EXECUTED !

ANALOG OUTPUT VOLTAGE: 4.35 VOLTS

NEW CONVERSION OR EXIT (N/E):? E

GOTO 440
```

A possible BASIC heading for the "DAK addressed" mode can be seen in Figure 10 and a "DAK repeat" screen can be seen in Figure 11. Figure 12 shows the block diagram and signal connections of the DAK. As can be seen in this figure every DAK channel receives an "occupied check" (FE) signal, issues a "data valid" (AE) signal and naturally issues an analog output signal in the course of every single transformation. In the "repeat" mode the 0 DAK channel also provides a synchronization pulse--indicating the period.



Figure 11. [Translation of screen.]

```

      DAK

      ** REPEAT MODE **
      -----

      ON CHANNEL 0

      BEGINNING ADDRESS (2049-40960): ? 15545
      NUMBER OF SAMPLES: ? 1215
      TIME BETWEEN SAMPLES: 100 US
      PERIOD TIME: 121.5 MSEC

      HARD-COPY (Y/N) ? Y
  
```

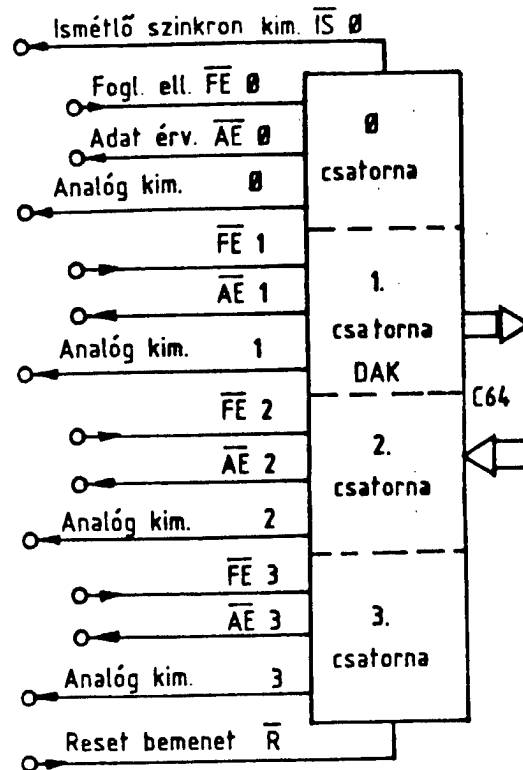


Figure 12.  
[The synchronization output, occupied, data valid and analog output lines shown in Figure 12 are described in the above paragraph. The last line, to channel 3, is a reset input.]

#### 4. Management of Control Outputs (KOK)

This service makes it possible for us to terminate on and off switches on eight independent lines, for example to operate relays. The outputs can be loaded in the 30V/40mA range. The BASIC program for this operation is of an introductory character; more "live" applications should be from the user's own program. Every single operation is accompanied by a "control data valid" (KAE) pulse. The operation can be erased with a reset (R) signal. The signal connections can be seen in Figure 13.

#### 5. Management of Digital Outputs (DIK)

This is the last function of the UNIPORT. With its aid data, TTL level digital signals, can be sent on four independent--8 bit--channels. The output signal is held between two sequential signal generations. Prior to every data generation the computer checks the "occupied check" (FE) signal line of the channel and sends a signal only to peripherals capable of receiving. Every data generation is accompanied by a "data valid" (AE) signal. A diagram of the signal connections can be seen in Figure 14.

Figure 13.

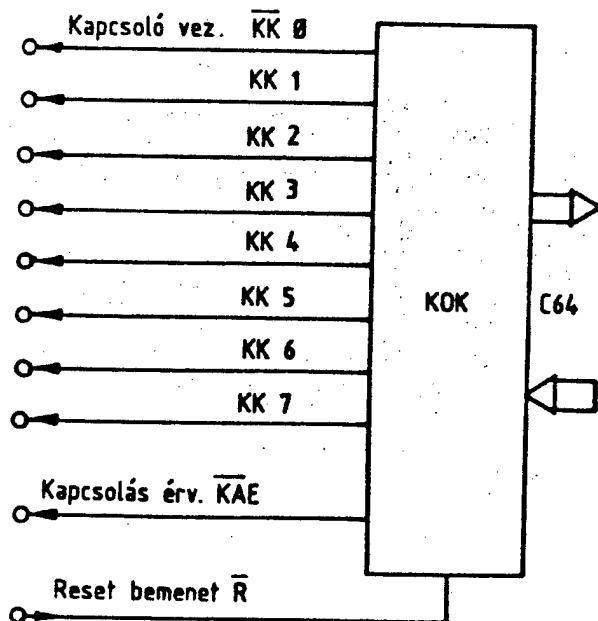
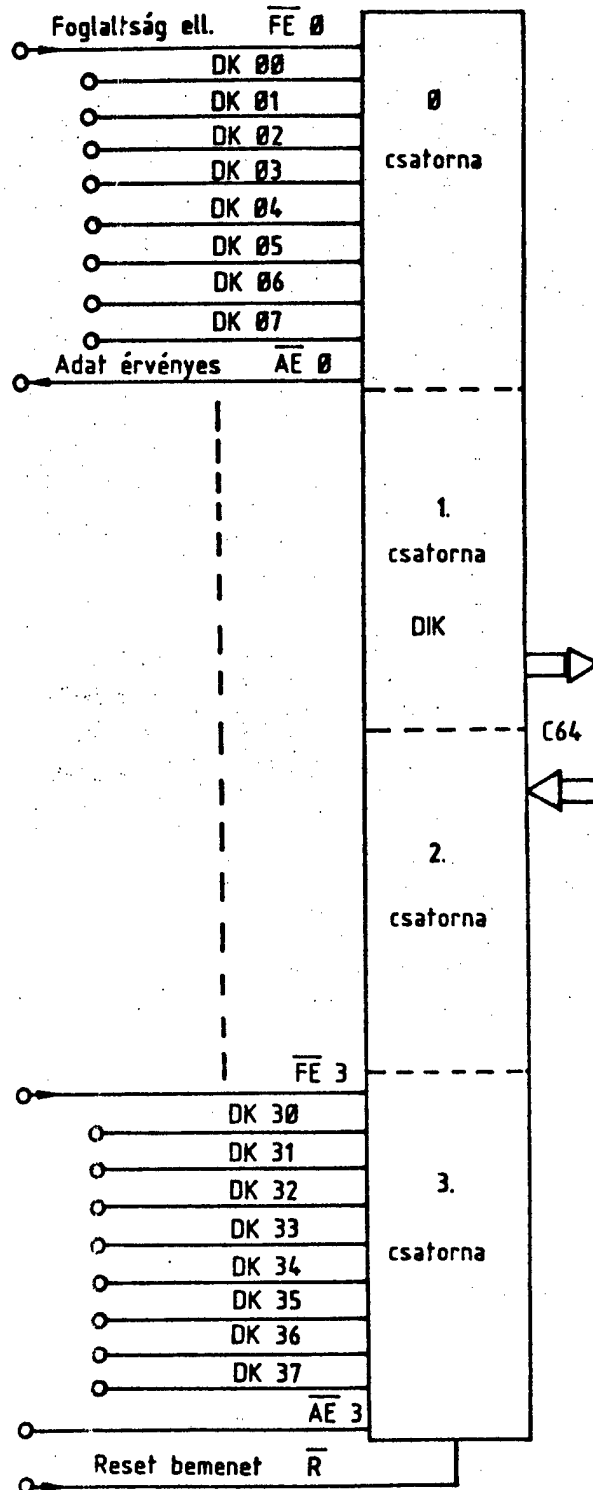


Figure 14.



[Figures 13 and 14 are described in the preceding paragraphs.]

A number of auxiliary functions supplement the chief functions of the system. We have indicated these in Figure 4 with arrows, letters and continuation serial numbers.

#### 6. Memory Check (T)

This makes it possible for us to display on the screen--as a table, in the form of decimal digits--the content of any sequential 100 elements of the memory of the C 64. By paging we can review the content of an area of any size.

#### 7. Hard-Copy (H)

With its aid any screen image can be recorded on a printer.

#### 8. Exit From Operation (K)

As a result of this UNIPORT gives back the base machine and the screen.

#### 9. General Operation Stop (R)

This is the reset function; as a result of it the transformations which are running stop and every output is zeroed out.

#### 10. Data Save to Disk (M)

This is the last BASIC function. With its aid the stored data can be recorded on disk from the memory of the computer.

As we mentioned earlier, the operation defined by the BASIC program is executed by a machine code program package--which can be accessed separately too. If we want to work directly with the machine code programs the programmer must put the operational characteristics directly into the work registers, he must define the free memory field and other constraints and then must call the desired routine.

The above tasks are given in the UNIPORT machine book, broken down into points, in detail for every operation, so realization of this mode does not require greater than average programming skill, and it does make possible more many-sided use of the services of the system.

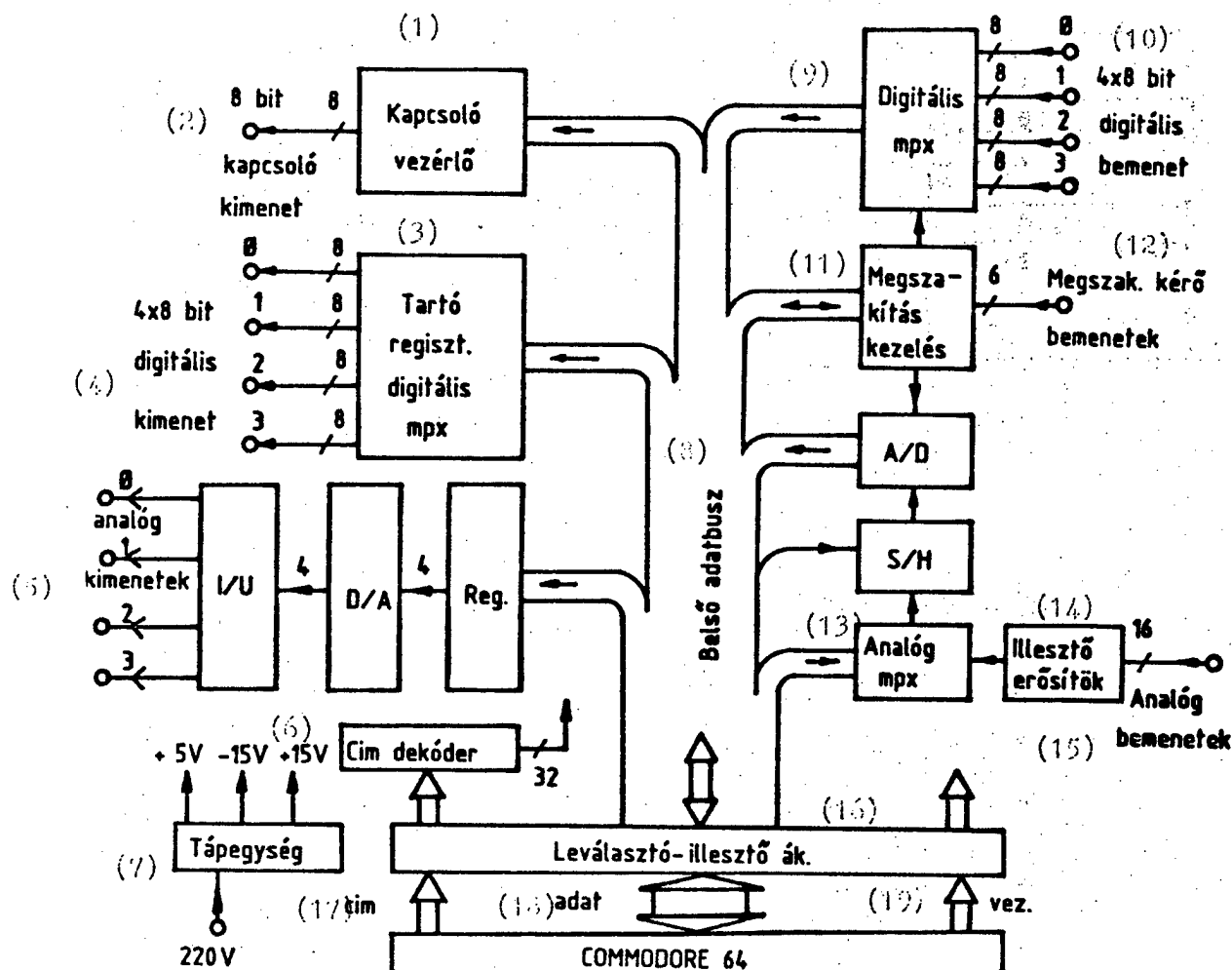
#### Circuit Structure

Figure 15 provides a simplified outline of the hardware part of the UNIPORT. In its system and in its circuit solutions we have not used special solutions deviating from the customary.

It is connected to the C 64 through the expansion slot directly to the microcomputer bus. In the interest of protecting the computer we realized the connection through matching-isolating circuits between the computer and the UNIPORT bus system.

An address decoder connection activates the circuits realizing the several functions.

Figure 15.



Key:

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1. Switch control                | 11. Interrupt management        |
| 2. 8 bit switch output           | 12. Interrupt request inputs    |
| 3. Holding registers digital mpx | 13. Analog mpx                  |
| 4. 4 x 8 bit digital output      | 14. Matching amplifiers         |
| 5. Analog outputs                | 15. Analog inputs               |
| 6. Address decoder               | 16. Isolating-matching circuits |
| 7. Power unit                    | 17. Address                     |
| 8. Internal data bus             | 18. Data                        |
| 9. Digital mpx                   | 19. Control                     |
| 10. 4 x 8 bit digital input      |                                 |

The ADK circuit contains a 16 channel analog multiplexer, a holding-tracking circuit and an 8 bit A/D transformer of the step-by-step approximation type.

There is a four channel digital multiplexer, with a width of 8 bits per channel, in the DIB unit.

When realizing DAK operation, in the interest of maintaining the output analog signal between conversions, we used four input storage registers and four independent D/A circuits. Operation amplifiers match the D/A cartridges to the output.

In essence the KOK and DIK circuits coincide, with the difference that we realised the KOK outputs with open collector inverters in the interest of direct relay operation.

Both contain the number of bus couplings and holding circuits corresponding to the number of channels handled.

A separate unit handles interrupts. This receives the interrupt requests of the peripherals connected to the digital input and of the timer of the ADK and DIB circuits. The hardware and software "reset" requests are realized through this also.

The C 64's own internal timer provides broad range timing for the timed modes of the ADK and DIB.

The analog inputs are protected to a value three times the operational input voltage; the analog outputs are shortcircuit protected.

The TTL circuit standards are valid for the digital inputs and outputs.

The UNIPORT is supplied with power by a double insulated power unit connected to the grid. Considering the relatively compact internal structure the +5V feed voltage stabilizer has external cooling fins.

The work registers of the system are located at decimal addresses 679-747 in the memory of the C 64. When using the BASIC program the location and maximum number of data to be stored are determined and provided by the program. When the machine program is used independently this is the task of the programmer.

Figure 16 shows the mechanical structure of the UNIPORT. The circuits are placed on five printed cards; these are connected through 64 pin indirect connectors to one another and to the connectors on the back panel via the internal bus.

We put the cards in a case manufactured by Kontakta.

Summing up it can be said that by using the UNIPORT the C 64 microcomputer becomes suitable--far surpassing its customary use--for direct observation and control of physical, chemical, medical, etc. processes, for sampling the signals of signal transmitters, instruments and measurements and for collecting and processing data. Manufacture of the device has begun.

8984

CSO: 2502/18

HUNGARIAN SHIPBOARD SYSTEMS FOR PROCESSING SEISMIC DATA

Budapest MAGYAR ELEKTRONIKA in Hungarian No 5, 1986 pp 34-38

[Article by Ferenc Kereszti, Jozsef Komjathy, Imre Molnar and Laszlo Pahi:  
"Systems for Processing Seismic Data"]

[Text] The primary goal of geophysical research even today is prospecting for mineral raw material reserves. Geophysical measurements are done on the surface of the Earth, in seas and oceans and even in bore holes and in the air. The method providing the most useful information and in many cases the combined, complex use of many methods leads to results in the search for a certain raw material. An ever more precise determination of the three dimensional image of geological structures hiding petroleum and natural gas deposits, of buried vaults, will be of primary importance in the future also.

The presently known continental hydrocarbon reserves of the world will not ensure a supply of this important fuel over the long run. So, in addition to additional continental deposits, there is a need for seeking out the occurrence of hydrocarbons in seas and oceans. An ever greater number of maritime bases producing petroleum and gas indicates the success of maritime geophysical research done near shallow coasts. It was thus an obvious thought to extend the scene of the measurements to search for and map the occurrence of hydrocarbons in seas and oceans.

In any case the sea is a promising scene for raw material research, and not only because of hydrocarbons. There are iron, manganese, copper, nickel and cobalt fields in the deep trenches of oceans and seas surpassing many times in quantity the present continental reserves. Bringing up mineral treasures from the depths of the sea requires very high level engineering skill and preparedness according to our present information, and requires the use of peak engineering technologies.

However surprising it may be Hungarian geophysics is playing a noteworthy role in research at sea--within the framework of a CEMA integration program.

In cooperation with similar institutes of the socialist countries, especially of the Soviet Union, the Hungarian State Lorand Eotvos Geophysical Institute (ELGI) has participated for some time in the development of a computer system operating on shipboard suitable for seismic research on strata under the sea.

Because of the nature of the task a computer system developed for maritime seismic research must be suitable for carrying out system functions for determining navigational location and for maritime seismic measurement and data collection.

In addition to developing a maritime seismic measurement and data collection computer system the ELGI was called on to satisfy user needs for a computer system suitable for (pre) processing of seismic data, and developing a containerized version of it.

#### Computers in Seismic Data Collection and Processing Systems

Since 1974 the ELGI has created a computer system based on the Videoton R-10 computer for maritime seismic research and for processing seismic data. The computer system, which in addition to the usual peripherals of the R-10 computer uses so-called geophysical peripherals coupled to the DMA (direct memory access) bus to create the possibility of direct memory access to the computer, has proved over the years that it is suitable to perform seismic data collection and processing tasks.

The geophysical peripherals are:

- a measurement and data collection station,
- a special fast operation executor,
- geophysical drafting equipment (plotter),
- disk stores carrying out special data sorting tasks, and
- magnetic tape units.

Manufacture of the R-10 computer ended in 1984, so it became our task to develop a geophysical system based on a new computer. We took a number of factors--not always just technical ones--into consideration when selecting the new computer. One of the most important requirements was the possibility of direct memory access. In our studies we kept in mind that the computer system to be developed might be made up of already existing equipment (computer peripherals or the data collection station itself) operating in other systems and/or of new units we developed ourselves.

The acquisition restrictions on high technical level computer technology products for building a geophysical system (such products as array processors, color graphic displays, fast--125 ips--and high density--6250 bpi--magnetic tape units) prompted the developers toward solutions by virtue of which it became possible to develop a system meeting the requirements.

The hardware developments, which include the development of the system technology and some of the geophysical units, were realized as service patents.

In the course of building up the system an essential factor was the goal that this equipment should be sold in socialist countries, primarily in the Soviet Union. This fact determined the ratio of Western units and parts which could be built in.

Another factor was that the inputs and outputs should conform to the usual forms and formats for seismic measurement and data collection, recording and display.

The R-11 computer of Videoton met the above requirements; its so-called monobus organization makes direct memory access possible and it has a uniform peripheral assortment. The computer itself is known on the main market and has a well supplied service network.

#### The Processing System Based on the R-11 Computer

We began with a general R-11 computer system which contains the following units:

- the central unit,
- a console display,
- 512 K words operating memory,
- fixed head magnetic disk units,
- magnetic tape units,
- floating point arithmetic,
- asynchronous/synchronous line interface,
- terminals,
- line printer, and
- a floppy disk unit.

This basic configuration provides a device background suitable for general purpose computer technology tasks. To create a special geophysical system we integrate the so-called geophysical peripherals into this system.

In the course of developing the system we studied the bus system of the R-11 computer and the usual forms, in this system, of coupling to the bus.

The R-11 computer is a so-called monobus system, which makes direct memory access possible for the units connected to the bus. The physical construction of the bus is such that one can develop a weighted importance order among the several units. This is a wired priority determined by the physical location of the control units placed on the bus.

The peripherals are connected to the bus through their couplers. The coupler mediates the exchange of data by the peripheral with the central unit and memory. The data exchange, which the coupler conducts directly with the memory, takes place as blocks.

#### Monobus Signals of the R-11 Computer

The function of the monobus is to ensure data exchange between the various couplers connected to the bus, the central unit and memory. At a given moment a coupler connected to the bus guides the data exchange; this unit is the Master. The Master conducts the data exchange with another unit connected to the bus; this unit is the Slave. The central unit is always a Master; the memory is always a Slave; and a coupler can be a Master or a Slave. We can divide the monobus signals into the following groups:



Data exchange signals. These signals make possible the exchange of data between a Master (guiding the data exchange) and a Slave (designated by the Master).

Access signals. These signals make it possible for a control unit to become Master of the bus.

Interrupt signals. These signals make it possible for a control unit to issue an interrupt toward the central unit.

Other signals. These provide general erase and the several indicators.

Because of room restrictions we pass over a detailed description of monobus signals and a description of Master-Slave dialogs.

#### Access to the Bus

In order to conduct a data exchange a control unit must acquire the bus. The system handling bus access is part of the central unit. A precedence system must be built up among the couplers (more precisely, among the peripherals) in the interest of realizing hierarchic relationships for bus access. The priority system is based on the principle of chained priority. Figure 1 illustrates the general operating principle of the system.

In this system the central unit has the lowest priority while the priority of the coupler physically farthest from the central unit on the bus is the highest. When processing a bus request the central unit issues a chained signal which runs through all couplers until it reaches the requested interrupt at the highest priority position in the chain. Upon completion of the current bus operation--if any--and if there is no higher priority bus request, the coupler is authorized to execute a bus operation.

#### Interrupt Request

The couplers located on the bus can send an interrupt request to the central unit, which interrupts the operation in process and executes a determined software task to spot and identify the interrupt request which has arrived. The interrupt process consists of three phases:

- the coupler sends an interrupt request to the central unit;
- the central unit identifies the coupler with a chained signal spotting the interrupt request;
- the central unit reads in the status word of the coupler with the highest priority which requested an interrupt.

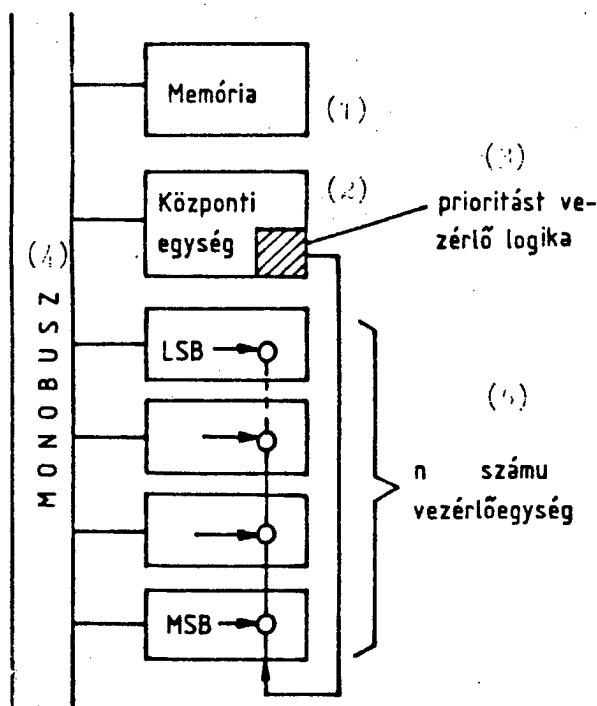
There is a hierarchic relationship among the couplers in the case of an interrupt request--similar to the bus access principle.

#### Structure of the Couplers

In order to conduct data exchange the channel command must first reach the coupler (Start Input Output/SIO). After receiving the channel command the coupler executes the channel command and then signals the completion of the task with an interrupt (IT). The AIO (Acknowledge Input Output) instruction issued following the interrupt makes possible an analysis of the cause of the

interrupt. Figure 2 illustrates the transmission processes of a coupler with direct memory access when conducting transmissions.

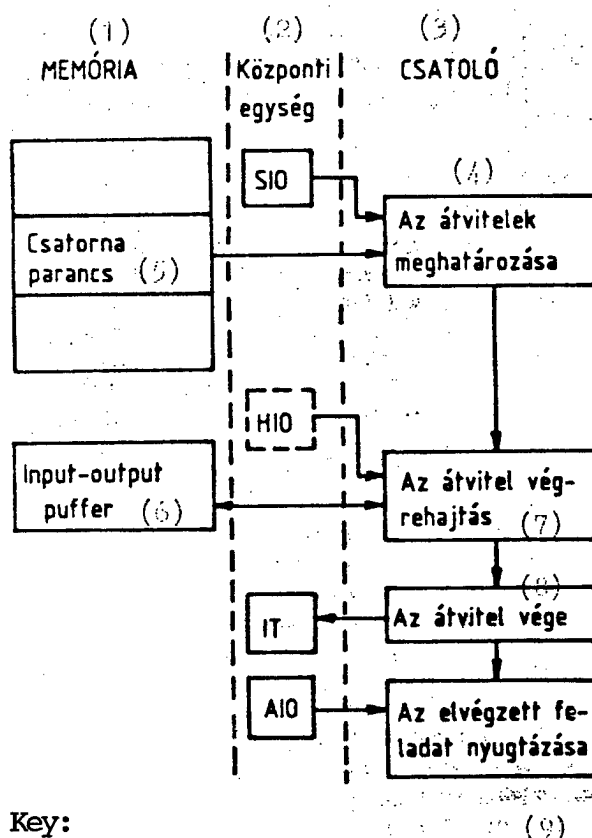
Figure 1.



Key:

1. Memory
2. Central Unit
3. Logic controlling priority
4. Monobus
5. Control unit number n

Figure 2.



Key:

1. Memory
2. Central unit
3. Coupler
4. Determination of transmissions
5. Channel command
6. Input-output buffer
7. Execution of transmission
8. End of transmission
9. Receipting completed task

The couplers execute the tasks defined by the channel command. In every case the task is an operation performed, in a data block, with memory (writing into memory or reading out of memory).

After reviewing the general principles, the integration of the actual geophysical peripherals into the R-11 computer system and the development of the couplers must meet the prescriptions used in this computer system.

The real-time maritime seismic measurement and data collection system based on the R-11 computer is the result of several years developmental work by a group formed in the Seismic Systems Development Department of the ELGI.

#### The Real-Time Maritime Program Package

The measurement and data collection system based on the R-11 computer realizes its tasks, which can be characterized as data collection, processing, recording and display operations, by virtue of a real-time maritime seismic program package. This program package controls data collection and the demultiplication of seismic data for channel continuous recording, it performs preprocessing of seismic data and displays the results of the preprocessing on a color digital plotter so that on every occasion these operations can be performed in the time between two explosions (these produce the data to be measured).

Starting up the computer controlled measurement and data collection system and giving the explosion order can take place in three ways:

- at a time and geographical place determined by the navigational computer, at the designated explosion point, as a result of an interrupt sent to the data collection computer;
- at regular intervals, from the internal real-time clock of the data collection computer;
- with manual control from the console terminal.

As a program the real-time maritime seismic program package works on two levels. The data collection and data processing tasks run at the higher priority level. Data collection, control of transmissions by the data buffers, recording channel continuous data on disk--making possible the processing of optional channel data--are all done at the higher priority level. After the data are sorted--demultiplication--the original data, already sorted as channel continuous--are read from disk and recorded on the magnetic tape unit. While this is being written to tape the processing of the data of the selected channel begins; as a result of this we draw a seismic time slice on the digital plotter.

During the data collection and processing cycle the real-time maritime seismic program package uses the following procedures in the single channel mode:

- demultiplication,
- channel continuous recording to tape,
- selection of an optional channel for processing,
- deconvolution,
- band filtering,
- amplitude regulation,
- color plotting.

In the multi-channel mode it uses the following procedures:

- demultiplication,
- channel continuous recording to tape,
- dynamic correction,
- summing,
- deconvolution (after summing),
- band filtering,
- color plotting.

The data collection and processing parameters can be given, or can be read in from the console terminal or from a punch card. Changed parameters are delayed and are valid only for the next explosion. The implicit values of the basic parameters of the real-time maritime seismic program package are:

- sampling time, 2 ms,
- channel number, 48 channels,
- data per channel, 5000 data/channel,
- coverage number, 24,
- speed function, the speed value characterizing the measurement environment,
- deconvolution, 201 point operator length,
- band filtering bandwidth, 201 point operator length.

The real-time maritime seismic program package provides for processing a few editing procedures used in the usual way, such as KILL, MUTE, REV, etc.

The program package performs the processing operations--summing, band filtering, deconvolution, amplitude regulation and dynamic correction--with the use of a special fast operation generator. More precisely, use of the special fast operation executor makes it possible for the system to perform preprocessing operations in the time between two shots.

The protocol of measurement conditions contains the name of the measurement line, the geographical location and the procedures and parameters participating in the processing cycle in the interest of later full processing and reconstructability.

We are informed of errors arising in the course of data collection or processing (e.g. peripheral error, faulty parameter) in the form of error messages sent by the operating system in the customary manner in the R-11 system.

Non-real-time programs run at the lower priority level during the data collection and processing cycle. Such programs are the signal/noise classification program and the cable noise estimating program, which provide important auxiliary data for processing the real-time seismic measurement data.

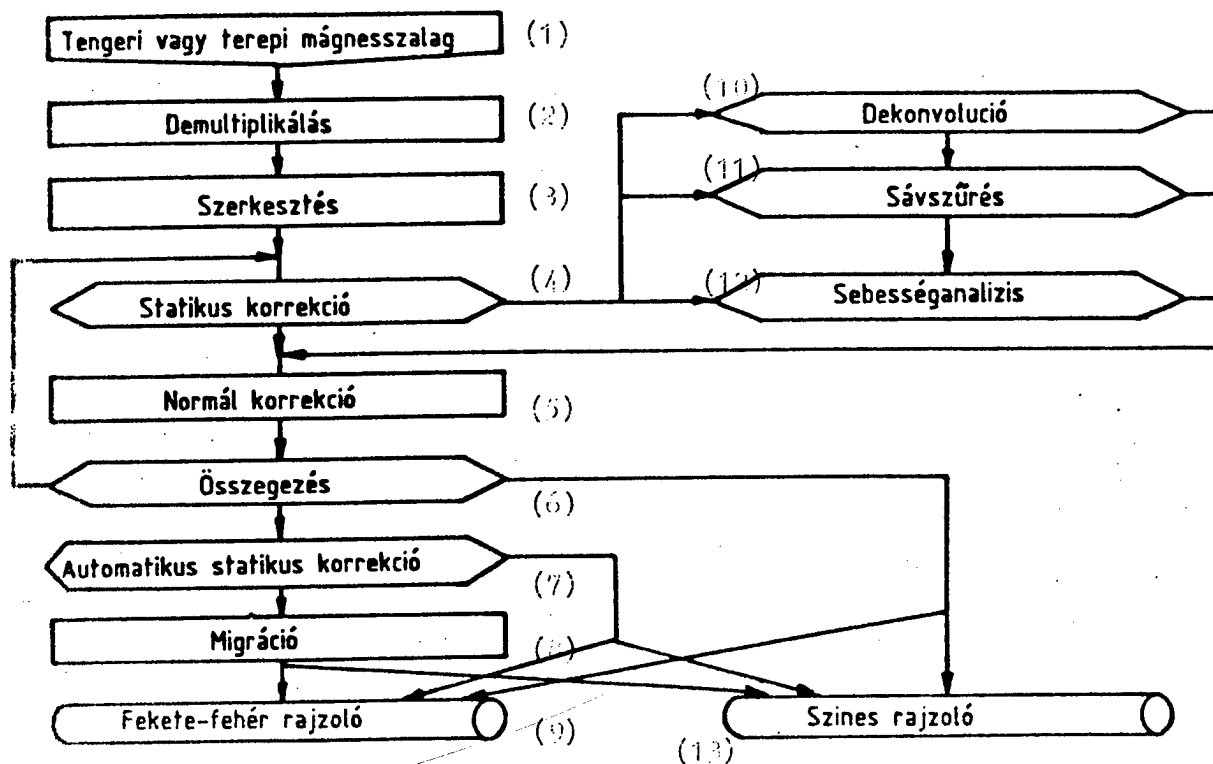
#### Procedures of the Express Seismic Program Package

The Express Seismic Program System makes possible detailed processing of material recorded by the maritime and continental seismic program system. The procedures used by the Express Seismic Program System are the following:

reading from magnetic tape, editing procedures, sampling, filtering, deconvolution, static correction, dynamic correction, summing, amplitude regulation, speed determination, migration and plotting.

These procedures make possible the performance of various seismic processing tasks. In case of need a procedure can be written out several times in the processing algorithm. Figure 3 illustrates the possibilities and sequence of the procedures customarily used in seismic processing.

Figure 3.



Key:

- |                                |                        |
|--------------------------------|------------------------|
| 1. Sea or field magnetic tape  | 8. Migration           |
| 2. Demultiplication            | 9. Black-white plotter |
| 3. Editing                     | 10. Deconvolution      |
| 4. Static correction           | 11. Band filtering     |
| 5. Normal correction           | 12. Speed analysis     |
| 6. Summing                     | 13. Color plotter      |
| 7. Automatic static correction |                        |

#### Autobiographic Notes

Ferenc Kereszti. I was born in 1949 in Kistarcsa. After completing my general school studies I graduated from the Kalman Kando Communications and Instrument Industry Technikum. I obtained my engineering degree at the Kalman Kando Electric Industry Technical College. My first place of work was Computer Technology Development at the Orion Factory. In 1974 I moved to the Hungarian State Lorand Eotvos Geophysical Institute where I first dealt with special

geophysical peripheral couplings for the Videoton R-10 computer and then switched to the R-11. My wife is a teacher and I have a son. I like to watch the more valuable creations of film art. I listen to music every chance I get.

Jozsef Andras Komjathy. I was born in 1938 in Diosgyor. I graduated from the Ferenc Foldes Gymnazium in Miskloc in 1956. In 1961 I graduated in communications engineering from the Electrical Engineering School of the Budapest Technical University. I worked first in the power industry and then, until 1966, in the foodstuffs industry. Since then I have been at the Hungarian State Lorand Eotvos Geophysical Institute. Here I dealt with digital instrument development and later with computer technology. Since 1973 I have been active in development of shipboard geophysical measurement devices and computer systems, as leading designer. At present I lead the seismic systems development department of the institute and I coordinate the sea research themes of CEMA as a member of the Scientific-Technical Council of the INTERMORGE organization of CEMA. My wife is a doctor of economics. My free time is taken up by cooking and by "Tacsko" [dachshund], who is a family member with full rights.

Imre Molnar. I was born in 1948 in Csomoro. I graduated in instruments and control technology from the Budapest Technical University in 1976. At the Textile Industry Research Institute I dealt with development of special microprocessor equipment. Since 1978 I have worked in the seismic main department of the Hungarian State Lorand Eotvos Geophysical Institute designing hardware units for the R-10 and R-11 special geophysical system. I wrote my doctoral dissertation on the Real-Time Geophysical System. My wife is a doctor of economics. At present all my free time is taken up by the apple of the family's eye, my infant daughter.

Iaszlo Pahi. I was born in Budapest in 1948. I graduated from the Budapest Technical University in 1971 in instruments and control technology. My first place of work was the National Metrology Office from which I came to the Hungarian State Lorand Eotvos Geophysics Institute in 1973. My first task here was to solve the DMA connection of geophysical peripherals to R-10 computers. I then began to deal with the design and development of special geophysical processors. This is still my task as group chief.

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## EAST EUROPE/MICROELECTRONICS

### STATUS OF HUNGARIAN ELECTRONICS PROGRAM DEBATED

Budapest MAGYAR ELEKTRONIKA in Hungarian No 5, 1986 pp 78-80

[Contributions solicited by the editors of MAGYAR ELEKTRONIKA: "Debate About the EKFP (Central Electronics Development Program)"]

#### Letter to Readers from the Editors

[Text] Our Dear Readers!

At the end of April we participated in a committee level debate of the draft report closing the Sixth 5-Year Plan activity of the EKFP. We thought that MAGYAR ELEKTRONIKA also should deal with implementation of the program. So we turned to a few leaders and experts of our profession asking them to give their opinion about the program, whether they had felt its effect and how.

But in the light of the fire at the IC manufacturing plant of the MEV [Microelectronics Enterprise] these questions changed too. We would also like to know, How to proceed? A few answers had already arrived. One well developed study arrived; our colleagues at Elektromodul took the effort to support their opinion with data.

The clash of ideas appeared as a new problem after the IC manufacturing plant burned down. We can even say with little exaggeration that the battle flamed up again. The question had been decided in the earlier 5-year plan--there should be domestic IC manufacture, there should be a domestic microelectronics industry, there should be an MEV. Some questioned these decisions and even wanted a revision in the question as to whether the new plant should be in the MEV. It would be good to know the opinion of responsible people influencing decisions in these questions! And it would be good if our readers could have a say!

We know that one cannot plan a debate; it either comes or not. Our goal now in publishing the contributions of the EMO [Elektromodul Electronic Parts Trading Enterprise] and Janos Goz is to give publicity to the evaluations taking place in professional circles. So the question is: Could any change be felt as a result of the Central Development Program for Electronic Parts and Subassemblies? What might be the proper way to continue?

We await your answers.

Comments of Janos Goz, Technical Director, EMG  
[Electronic Measuring Instruments Factory]

[Text] The world-wide swift development of electronics and the appearance of applications in every area of life--from numeric machine tool controls to agricultural electronics--present constant developmental and manufacturing tasks for enterprises dealing with electronics. Day after day these tasks mean satisfying new qualitative and quantitative requirements.

For the manufacturers of electronic equipment development means the creation of ever more complex, reliable devices and systems offering more services which can be operated at small cost. But for this they need reliable, powerful, interchangeable parts requiring little space and power and corresponding to the international trends or standards; and they need them in sufficiently large quantities.

Viewing the results of the first phase of the Central Electronics Development Program--thinking of the Sixth 5-Year Plan period--from this viewpoint, that is parts supply to equipment manufacturers, it can be established that the parts industry was able to satisfy the needs only in part. It was not able to realize that dynamic development with which the relative backwardness of the parts industry might be reduced.

It increases our problems that so far we have not succeeded in getting really modern microelectronic parts from the socialist countries. But the principle of selective parts development was the creation of a "hard" exchange base for this purpose.

Recognizing, naturally, that in the present situation of the country the capital needed to create a modern parts industry background is not entirely available, we think that a deliberate and swift development of microelectronic parts starting from the crucial needs would be able to reduce the backwardness and import requirements of the entire electronics industry.

And this is fundamentally necessary in light of what was said in the introduction. For example, one cannot sell numeric machine tools without modern controls, or one can do so only below the price. So the backwardness of the electronics industry has an effect on the level of related areas as well.

We hope that in the course of the Seventh 5-Year Plan the parts industry will be able to satisfy the needs in the stressed areas--e.g., micron resolution IC manufacture, parts suitable for surface mounting and more reliable elements.

Article by Ferenc Kis-Kovacs, main department chief, and Laszlo Varga,  
department chief, of the EMO [Elektromodul]

[Text] Concerning Implementation of the Central Development Program for Electronic Parts and Subassemblies in the Years 1981-85

Elektromodul is the largest vendor of domestic electronic and electromechanical parts. It is our estimate that multichannel sales in this area do not subtract more than 10-12 percent from the trade of our enterprise.



So we can say that the volume of parts sold by us makes up nearly 90 percent of domestic use, and the conclusions drawn from these figures are acceptable for a complete domestic panorama.

#### The Goal of the EKFP and Its Fulfilment

According to the program the production of electronic parts should have approached 7.5 billion forints in our country in 1985. The goal--because of various problems, primarily investment, license purchase and similar problems--was fulfilled to about 50 percent while the investment sum originally proposed, around 6 billion forints, was used up. The percentage ratio of fulfilment was a little more favorable in the area of microelectronic parts, where nearly 60 percent of the goal was met.

Some conclusions can be drawn from the data:

--During the time of the program domestic sales of parts of domestic origin increased by 18 percent, the ratio of them in supply was 29 percent. The EKFP had planned a 51 percent share for 1985! A lag of this magnitude from what was planned "resulted in" a great decline because parts of domestic origin had a 40 percent share in domestic supply in 1981!

--Together with a domestic growth hardly exceeding 400 million forints the increase in parts of import origin came to nearly 2 billion forints and their ratio in domestic supply rose from 60 percent in 1981 to 71 percent!

--Taking into consideration these same two points in time the domestic supply ratio for passive parts improved from 55 percent to 59 percent, the 30 percent ratio for electromechanical parts moved to 29 percent, while there was a significant decline for active parts--the 26.5 percent ratio for supply of domestic origin in 1981 fell to 19 percent.

--The growth in domestic demand was greatest in the area of active parts--as the KFKP had planned.

--The theme of IC's would require a separate analysis. We were able to satisfy from domestic sources only 12 percent of the domestic demand for the most quickly increasing parts demand within active parts. The annual trade in IC's, coming to 2 billion forints, is expected to increase further, but we have not yet received from the MEV prototypes--figuring in the catalog--which might have a significant role in reducing capitalist import after testing and then series manufacture.

It does no harm to continue this analysis because of the fire at the MEV, especially because from this we might better approach plans for the future in connection with IC or chip manufacture!!!

--In 1985 the MEV had an IC export worth 550 million forints--calculated at domestic net prices--but in 1984 we imported capitalist chips worth 263 million forints at border parity. Four fifths of the export was in the socialist relationship, with a very high capitalist import fraction!

Whatever factors we weigh the practical result of the 4 billion forint investment at the MEV appears very paltry up to now!

Approaching the IC theme from another side:

--The world-wide growth process evident in electronics can be felt well in the growth in the domestic use and composition of IC's.

--In the marketing competition our equipment manufacturers can stay somehow on their feet only by using modern microelectronics.

--Microelectronics will have a swiftly expanding and ever more important role in areas many times broader than up to now.

--It follows from this that the demand for integrated circuits in the future also will be significantly above the average parts demand.

--Without a fundamental change in present conditions, if the necessary conditions can be created at all, domestic manufacture will be able to counterbalance this two-sided pressure only in very small part in the future also.

#### The Effect of the Program in Replacing Capitalist Import

The EKFP had planned the ratio of capitalist import in domestic supply at 34 percent for 1985; but the actual figure was around 55 percent. The gross forecast pertaining to total domestic need proved to be about 100 percent correct--if we include parts movement outside the EMO as well--but within this it overestimated the reduction in capitalist import or the possibility of replacing it. During the past 4 years the replacement of capitalist import--always calculating only the replacement in the subject year--came to 150 million forints.

The cumulative figure, as the numbers show, somewhat exceeded 400 million forints for the 4 years. This value is only 20 percent of what the EKFP planned and for which it devoted material support.

In the above point, as an example, we touched on the quality level and quantitative possibilities achieved in parts manufacture and supply and those expected this year. This year also the manufacturing background will provide only a very modest base for domestic replacement of additional capitalist import, at most a few tens of millions of forints.

The theme of capitalist export is similar. The qualitatively competitive parts participate primarily in domestic supply; some extra capacity provides a commodity base for capitalist export of 12 percent of all domestic parts supply.

A fundamentally positive change in both capitalist import replacement and capitalist export can be based only on a significant development of the domestic manufacturing base. Neither the pace thus far nor the technical base for the development thus far of--for example--the MEV present a reassuring picture.

In our judgment either we develop a new EKFP, one which takes external and internal possibilities into consideration realistically, one which contains the necessary conditions, or we must reckon with remaining at a lower level (lagging behind) in the area of electronic parts manufacture.

#### The Technical Level of the New Parts

A comparison of the technical level of new domestic parts to the European level contains a number of stumbling blocks, for it pertains to only a brief time. We should recognize not only that the development of technology is faster than ever before but also that there is no presumption that this trend will slow in the least degree in the future. If we add to this that electronics has and will have the leading role within the general technical development we are free to say that new parts may be good, even modern, when setting the plan goal, but by the time series manufacture is realized the backwardness will have reached several years. This statement is valid primarily in a capitalist comparison.

In regard to socialist relationships we can record as a fact that our government program for the development of electronic parts started late compared to the programs of other socialist countries and we hardly have any considerable developments which resulted in convertible products. The gap in domestic parts manufacture and development did not narrow in recent years; indeed, it unambiguously increased in regard to both active and passive and electromechanical parts. Recognizing the investment need of the branch, the well known difficulties in purchasing licenses and the extraordinarily slow time for adapting them, we judge that we have no chance even of maintaining the present lag time. If the technological gap is not to increase further there is a need for extraordinary efforts, concentrating our forces, concentrating our acquisitions, an efficient introduction of our assortment catalogs, approximating optimal series sizes and effective cooperation with our socialist partners.

The picture in a socialist comparison is a degree more favorable, for the situations are similar in regard to material strength, although some socialist countries started to realize their electronic development programs earlier and sometimes with greater expenditures.

In this regard the study should be done according to the three chief parts areas.

In the area of passive parts our developmental results are considerable, as is shown by demand. If the primary material problems do not pinch in this area too then we could be suppliers to the socialist countries in some areas. But if we are not able to undertake this we must reckon with the fact that our technological advantage is only temporary.

In regard to electromechanical parts the situation is not nearly so favorable, for we can hardly come up with products which qualify as hard commodity items in socialist countries. Our progress under way in the area of connectors is not unambiguous either, for this is precisely the area where a change in fashion could cause the greatest disappointment (e.g., the disappearance of

modular devices in the area of radio and TV, the spread of flexible and multilayer printed circuits, etc.). So in this area we are not so bad in a comparison, but this is due not to our merit but rather to the general neglect of electromechanical parts development. Of course the causes of this incorrect policy could be analyzed and explained in the case of every socialist country, but this does not belong among the present thoughts. One thing, however, must be noted here, the value of electromechanical parts inside equipment is so significant that it deserves much greater attention and development. Some areas of it can be cultivated in small plants, as many Western European examples prove.

But the profile connected with the EKFP should certainly be given to the large plants (e.g., Kontakta), together with financial cover for it, because otherwise they will feel that obtaining certain supply items runs counter to their own economicalness.

The area of active parts is the most difficult in this comparison, and it causes the most debate among experts. Our briefly summarized opinion is drawn from our experience as a commercial and technical customer service.

The manufacture of low power discrete semiconductors in every socialist country where there is such manufacture is essentially equalized, the model assortment is essentially the same. In the area of power semiconductors--which are extraordinarily significant, because in the long run they will not be replaced by integrated circuits--Hungarian manufacture is essentially insufficient, which is incomprehensible because we are not talking about the most complex technology. In the area of integrated circuits, in our opinion, we were proud for too long of the Fairchild assembly plant, which was modern 8 years ago, by Eastern European standards, and we did not develop it properly but rather debated the necessity of chip manufacture. In the meantime some socialist countries created larger and higher level assembly-testing capacities, and made more progress in chip development too.

To sum up, neither the numerical values nor the findings or analyses connected with them provide a reassuring picture of the domestic results achieved thus far in the production of electronic parts. Development is continuing according to the program, and it is indisputable that the production of electronic parts must progress a great deal to serve the spread and quick growth of domestic electronification. The area of passive parts developed significantly in the past period, and the developments under way there offer a reassuring picture also. Further expansion of capacity would provide a way to satisfy domestic needs.

The lag is very great in the area of producing electronic parts; it can cover only one third from domestic production.

The most swiftly growing need is in the area of semiconductors and IC's. Development in this area is most demanding from the viewpoint of investment; it changes most quickly from the viewpoint of technology and from the viewpoint of licenses the most modern is not accessible. So this area requires the broadest analysis, laying the foundations for future decisions so that the weak results of the Sixth 5-Year Plan will not be repeated.

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HUNGARIAN TECHNICAL DEVELOPMENT OFFICIAL INTERVIEWED ON ELECTRONIFICATION

Budapest MERES ES AUTOMATIKA in Hungarian No 9, 1986 pp 329-333

[Interview with Laszlo Pal, main group chief in the OMFB (National Technical Development Committee), by the editor of MERES ES AUTOMATIKA]

[Text] The interview took place on 20 May 1986. The interview was recorded and one can read in the columns of the journal a written version of this recording. Thus it bears the signs of a live interview.

[Question] What more important industrial potential characteristics should a little European country, which is moderately developed, have to ensure the possibilities for further development (naturally those needed to preserve its place in the rank of nations)? Which of these do we have?

[Answer] I believe the question is too narrow. What industrial characteristics a country has is little in itself to be able to answer whether it can develop further or not. Everyone can develop further if he devotes his forces to laying the foundations for the trends of further development, from industrial, economic and social points of view. Hungarian industry could develop further in very many alternatives, if we put our resources into industry, if we grouped our intellectual forces around industry, if we subordinated our commercial activities to the further development of industry. So it is too little to talk about only industry itself; going beyond this we would have to formulate a great many things to fix the foundations for further development. I think that there is a determination at the policy level that the Hungarian processing industry should become the driving force of the country, and we will get the developmental conditions necessary for this, within the frameworks of the possibilities. Perhaps the given conditions of industry are not so good as they were, let us say, 6-8 years ago, for we know that even keeping investment possibilities at a given level is not always sufficient, but at the same time we have an industrial culture with an acceptable base and we have relatively broad international knowledge. If the environment complements the thinking centered on industrial development then there will be further development here. Discussions on a vast scale are taking place in the interest of this. Perhaps it is too early to see the results, especially if we are talking about industry as a whole. For some areas of industry it is certain that the further development will soon be felt.

[Question] The planned rate of development, about 5 percent, lags behind the developmental pace of the world's electronic industry. Is this enough?

[Answer] In answering let me say first that even in 1981 the Sixth 5-Year Plan did not prescribe for the electronics industry a developmental pace greater than this. Then also our opinion was that such a thing does not exist, to develop by 5 percent in the electronics industry means a quantitative decline. One cannot maintain the quality level at a 5 percent development rate. And it didn't happen either.

Even in the restricted environmental conditions system of the past 5 years the rate of development in the electronics industry reached 9-10 percent, in places it exceeded this in some branches of the electronics industry. We are convinced that the general developmental rate in the electronics industry as a whole will be around 10 percent in 1986-90; in some areas it will be faster, in some perhaps somewhat slower.

[Question] With about \$60 of electronics per inhabitant, what place does this give us among the socialist countries?

[Answer] One measure of electronification is the accumulation rate of electronics. As a world average the 60 dollars per inhabitant per year is low; if we ignore the more developed region then it is a satisfactory enough level, but there are those substantially lower than we also. With our \$60 we are about average among the socialist countries.

The growth rate in Hungary was highest in 1981-85. Let me give an interesting figure, which may not be well known; when investments at the national level decreased in absolute numbers in 1981-85 in every area, this was not true only of the use of electrotechnology. There was fast growth in computer technology, instruments and automation, in absolute and relative value. These figures indicate, or these processes prove, that a cultural change took place in the country, one which is capable of and wants electronification. Is this enough? That is still a big question today.

[Question] In what areas will the Seventh 5-Year Plan make it possible to reduce our disadvantages?

[Answer] Concerning the use of electronics I would say primarily that we have gotten into a definitely better situation than we were in in years past. In the electronics industry, as I said, I personally dare to count on a pace similar to what was realized in 1981-85; in reducing our disadvantages, perhaps just because of the cultural changes, measurement technology and automation will come into first place, but the infrastructural foundations needed for the development of telecommunications will be produced during the Seventh 5-Year Plan too. The reconstruction of the telecommunications network, automation of the regional exchanges and replacing the large exchanges will begin, and this will make it possible to bring about a significant quantitative change after 1990. I believe that this process also will characterize the reduction of disadvantages.

[Question] In what areas does our electronics industry have good positions and in what areas is our situation definitely disadvantageous?

[Answer] It is a curious thing. I believe we have good positions on the expert side; our custom solutions are not bad. We are weak on two sides. One is the situation of our electronics parts supply and within this the size and assortment of our parts industry. Our other weak side is to be sought in the level of the technological culture for equipment manufacturing. For years it was presumed that the equipment manufacturing industry was not an investment demanding branch, not a technology demanding branch, so technological developments were very largely neglected.

Our position is good in the design area; one can find a nice number of good results in little themes, but not in mass use themes; there have been very many patents in recent years, but we could not really organize industry around them. If we could concentrate our forces so industry developed around such original solutions then this would have an economic result for the country in the years ahead.

[Question] What is the infrastructural situation of the country from the viewpoint of electronics--going beyond the telephone and telex net and including the "intellectual infrastructure" too?

[Answer] One has to look at the infrastructure in very many ways from the viewpoint of electronics. I believe that the infrastructure should include the institutional background and the status of research and development, service and "engineering" activity. We have to consider the status of education and a number of our economic and legal regulations which, I believe, can be regarded as elements of the infrastructure. The picture is very mixed. New supply and development institutions have developed especially in the area of small undertakings, but the efficiency of these, in my opinion, is sufficient for small enterprises but not sufficient for the national economy. The efficiency of them is not sufficient in the sense that they are trying to profit from the possibilities offered by their infrastructure through their own immediate production activity, so their services are realized in a certain narrow sphere. Pretty near everything can fall through the sieve of "engineering" activity in Hungary. A willingness and ability to undertake designing, contracting activity are missing in many areas. Cooperation and import acquisition problems contribute to this, but the really and truly proper organizations have not appeared in every area. The export constraint weakens domestic undertakings too, the export interest in one direction and the export constraint in another direction. Not enough infrastructural strength remains for our domestic business. If we can make changes in the regulatory and incentive relationships here then one can expect that the domestic situation will change too as a result. The educational infrastructure will develop, perhaps not at the rate we would like. Developmental ideas here are squeezed within the momentary limits of the economy, but development can be expected. For example, through the creation of the new informatics faculties, through a better supply of tools for university and college faculties, through the development of new educational thematics, sometimes through mass training and leader training too. Somewhere in the environment of the infrastructure we should list those regulatory elements which are related to trade in

intellectual products, domestic trade in them, license trade and software trade. Today there are more artificial corns in the shoes here than real ones. Legal and economic agreements between ministries are being made as to how to encourage this domestic trade in intellectual goods. Isn't it the truth? We talk a lot about export but less about domestic trade.

[Question] What foundations did the Sixth 5-Year Plan provide for the electronification tasks which have to be carried out in the Seventh 5-Year Plan?

[Answer] I believe that relatively positive foundations were created. Again I would turn back to the social medium, the question of public attitude. The Sixth 5-Year Plan laid the foundations for a change of attitude in which, today, state, political and social guidance demand the purposeful use of electronics ever more seriously. Even in non-technical circles it is recognized that our achievements in the future, in connection with competitiveness and conservation of material and energy, ensuring quality, depend on electronification. In itself this recognition also means that the Sixth 5-Year Plan started a management process which wants to support electronification. The contradictions have appeared more on the industry side, where the internal development of our industry--I am not talking now about quantitative development but rather about the development of the internal structure, of technology--did not reach the level which would be required for Hungarian industry to play a suitable role in the electronification process of the Seventh 5-Year Plan.

[Question] Wouldn't you consider a more vigorous electronification optimal from the viewpoint of our ability to increase national income? I know that this is a difficult question, because you have to represent the official position too, but the electronics public opinion expects you to fight for the developmental dynamic they consider justified.

[Answer] The plans which have been developed contain an achievable, sober compromise. Naturally we might enter the lists for a faster paced electronification, but the conditions for what has been decided can be ensured. But if a person listens to his emotions then he agrees with the idea behind the question, that it would be better to progress more quickly. On the basis of reason, however, he is satisfied with the present compromise, with the idea that one cannot give up every hope of going further in our compromise. Again the reserves seem to be not only on the economic side but also on the attitudinal side. There are areas of our social life, of our economy, where they have not yet recognized how electronics can take the place of traditional solutions in the long run and in a more economical way. We must continue to support this recognition and if in the meantime modern ideas mature than one can expect that a more vigorous electronification may occur in certain partial areas.

[Question] A development more dynamic than the industrial average can be ensured by capital flow. At present the following forms of capital flow are known:

- at the state level, state support;
- the state competition system (export expanding credit from the OMFB, the



OTKA [National Scientific Research Fund], the Ministry of Industry, etc.);  
--bonds (except for the telephone bonds, which come from the public, electronics does not participate in this form);  
--foreign working capital;  
--and perhaps we should include here the capital flowing into the GMK's [economic work associations] (e.g., from doughnut makers, if any).

What is your opinion about these forms, their efficiency and role in the domestic electronics industry, where might the present situation be changed?

[Answer] I would consider of primary importance the development of capital links between the electronic equipment manufacturing and parts manufacturing branches. We will have to return to this later, but what role our parts industry plays in the development of Hungarian industry depends on what sort and size of capital links can be created between the equipment manufacturing and the parts manufacturing branches. If the parts industry remains on its own in the future also and must develop from its own capital or direct state capital contributions then there is always the danger that it will orient itself toward the markets that are simplest for it. So, one can imagine that the question of domestic parts needs will be subordinated to certain export interests. So, I consider progress here absolutely important. We can count on state sources in the parts industry in the future also; we cannot count on investment sources in the equipment manufacturing industry. But to a large extent the state research and technical development programs and projects also exist for the other branches of the electronics industry, and technical development in the area of electronics is aided by several billion forints in central sources. As for the import of foreign working capital--I believe that it is not ruled out that there will be events by the time the article appears. It is perhaps a well known fact that the government has decided on state preferences for the import of foreign working capital for just these areas, for the use of electronics and for the electronics industry. This also characterizes the effort of economic guidance to attribute a large role to electronics in changing the domestic structure. Naturally the foreign capital will not come of itself so we have to ensure for foreign capital that it is not a bad investment if it tries to work in Hungary. This has not been proven in every area. There will be events--and I would like to emphasize especially that we should think in terms not only of Western capital but also of the import of working capital from socialist countries. Indeed, such thinking is going on.

I would also consider another direction of capital flow important, among our equipment manufacturing enterprises, especially joint capital investments aimed at research and systems level technical development. So, if our enterprises jointly finance the research and technical developments and conditions necessary to develop large systems--we will have much more chance of creating marketable large systems. Such R and D oriented cooperation might greatly reduce the enterprise dispersion which can be noted here, in part, in electronic equipment manufacture.

[Question] I believe that this is akin to the statement that in the final analysis the Hungarian electronics industry is one firm of Philips size, or half of Philips size, and that we have not exploited the strength of this.

[Answer] Actually it is the same question if, let us say, we jointly realize Philips type functions in technical development, technological unification and trade, or cooperate in an ever larger enterprise sphere, then we might begin to become like, if not Philips, then an electronics enterprise of world firm size.

[Question] Would not a preferential tax system, supporting electronics investments, aid the electronification process?

[Answer] I would like to say that within the framework of state programs steps have been taken and further steps are under way in the interest of preferential taxation. For example, duties are a form of taxation, where there have been domestic decisions about significant duty reductions, about duty reductions supporting the electronics industry too. These include the large reduction in duties on the import of the most modern technologies and technological equipment for equipment manufacture, on parts import, on import of some primary materials and sometimes on the import of licenses and know-how. The question of other taxation preferences is on the agenda; as of now I could not predict when they will be introduced, but I know that there will be additional tax preferences in the area of especially modern new technological trends. In part there have been other regulatory changes. As an example I might mention tax preferences supporting software trade, e.g., the consumers turnover taxation of software has been abolished, elimination of consumers turnover taxes for some organization types is on the agenda, in some places, and not only in the parts industry, the use of so-called mixed cash boxes is on the agenda, in the interest of strengthening import competition and technical contacts, this would depress the price of Hungarian products produced domestically and make them more competitive on the market. And a number of other little questions, so there is a good number, not of global regulatory changes, but of little ones, modifying smaller regulations now standing in the way of electronification.

[Question] How do you judge the status of domestic basic research, applied research and development belonging to the electronics industry, and the links among these?

[Answer] I consider the status of research, basic research and applied research and the links among them to be contradictory. From a number of viewpoints, primarily because I feel that a process of leveling is taking place among the various organizations. The organizations doing basic research and applied research and the independent developmental organizations are appearing in concrete undertakings, sometimes in production, to an ever greater degree; and at the producing enterprises they are turning ever greater attention to their own research and development work. There is still an organizational separation but the substantive difference is decreasing. This has negative and positive sides. It is positive that the results of research are not simply lost, if the research institute realizes them. The negative side appears in the fact that sometimes--and this can be observed in reality--

there is multiply redundant research work going on and inter-enterprise cooperation and the cooperation contacts needed in R and D activity are weakened. There is an effort within the framework of national research programs and technical development projects, at least on the part of the OMFB and I presume it is similar for other institutions, to closely link basic and applied researchers and developers and the manufacturing organizations and those that will deal with trade later even when developing the research projects, by virtue of a system of many-sided contracts and contacts among them and with special associations. We try to strengthen this cooperation with outside effects, artificially, by announcing joint competitions. It does not succeed everywhere, but in a number of areas I can say that already such many-sided cooperation has been created. This is the attitude of a Hungarian sized firm. The discussions are not successful everywhere, I admit, for there are cases where the undertaking of determining significance is one not inclined to enter into such a cooperation, because they do not want to be dependent on the smaller ones, or they have slightly different philosophies.

[Question] It is known that the domestic electronics industry is not a foreign exchange producing branch, but it needs a lot of import material. What is the consequence of the above fact?

[Answer] The central problem of the Hungarian economy today is that in the interest of reducing the debt we are forced to considerable convertible exchange export. But producing convertible foreign exchange is not the only profitable thing for production. Our electronics industry contributes very greatly to the national income, nor is its role small in domestic electrification processes, so the convertible foreign exchange balance is not so negative as is said about the branch. Let me give just one example, even in convertible relationships the foreign trade of the computer technology industry, the Hungarian computer technology industry, the trade in computer units or subassemblies, has a positive balance. In a word, the foreign exchange balance measured in computer technology products was positive, although this is not what is said.

[Question] Propaganda for this fact should be increased!

[Answer] Well, yes! At the same time, propaganda has its utility limits. An item: Our software export has great propaganda, but you should know that our hardware export is a good bit more than our software export, even in the capitalist relationship. Foreign exchange problems can be felt especially in parts supply, and I see no other possibility here than for the joint parts development programs of the socialist countries to reach a level where this very great foreign exchange burden can be reduced. Naturally, Hungary also must take its own steps to this end.

[Question] Assortment has been a serious problem unsolved for years.

[Answer] Permit me not to answer the assortment question. I believe it would be good to ask industrial experts about this. But I will note in parentheses that what we said about capital flow, the model where the equipment manufacturing industry should participate in operating the domestic parts industry, with material interest in it too, this might make possible

standardization and substantial progress in regard to assortment. Especially if it were linked to commercial activity too. So, if the Microelectronics Enterprise of today, Remix and the EMO [Elektromodul Electronic Parts Trading Enterprise] would fuse with the interest sphere of equipment manufacture then a lot could be done in the interest of assortment, even automatically. The conditions for this do not yet exist. We should think seriously about this version.

[Question] It is said of Hungarian software that it is of good quality and has a good reputation. Is this also true of the software for CAD/CAM systems?

[Answer] Unfortunately not. Hungarian software is good in certain areas, primarily--as I understand it--in the area of software products making use of a very high level mathematical apparatus and its advantages include what is actually a disadvantage, that Hungarian software work is not very expensive. There are some achievements in CAD/CAM software, it is good enough in one or two special areas, we have CAD programs of satisfactory quality for domestic industry. There are such in the electronics industry, there is an example in the construction industry, but it is not by chance that the embargo is strongest in the area of CAD software. In the outside world they have developed very valuable software here with a gigantic concentration of forces; we are not competitive with this today for a number of reasons, partly for hardware reasons, partly for organizational reasons. A process is developing where we would gradually like to concentrate our strength on domestic CAD software development work, but it will be a good few years until this is realized.

[Question] Without doubt CAD/CAM systems are the keys to the technical activities of the future. This requires computers, software, peripherals and robots. How do we stand with peripherals and robots, with graphic plotters?

[Answer] The situation will improve in the area of CAD peripherals. In the first place some of the developments relating to graphics peripherals can be regarded as completed, some things have gone into production or will in the coming months.

Hardware supply will definitely improve from the computer side and the peripheral side. As for the CAM side, thus the computer aided manufacture side, and I am not limiting the question only to robots, there have been significant changes in recent years in the area of various hierarchic automatic controls, manufacturing systems, manufacturing cells, NC controlled machine tools and other machinery. A structural change in the Hungarian offering may be coming; it is true that our factories are not sufficiently able to buy. So again we come back to the lack of money as to why such modern controllable techniques are not used widely enough at the user enterprises. We have examples where the possibility of progress in CAD or CAM is in our hands; to what degree this can spread depends on limiting or ending the shortage of money. This is the situation with robots too. In itself a robot is not a significant tool; it is significant if it operates as a part of a complex system. We have few complex systems; our robots are enough for these. If we get more complex systems then, I hope, we will reach a stage where we can talk

about a shortage of robots in Hungary, but for the time being, unfortunately, this is not the case.

We have some plotters, small sized ones, but very precise, suitable for multi-color drawing; the Hungarian offering today has flat and drum plotters. We are weaker in large size flat plotters, but in part these could be obtained from socialist sources. Graphics digitizers, mouse systems and the related software have appeared in the Hungarian offering, but they have not yet spread widely.

[Question] Do you consider the creation of an Industrial Park realizable in Hungary? What should be done in the interest of this? What advantages would it offer under Hungarian conditions?

An Industrial Park as a swift realizer of new ideas, financier of ideas, as an intellectual and physical infrastructure needed to cultivate peak technologies.

[Answer] What do we mean by Industrial Park? We read all sorts of publications, there are many interpretations in Hungary. What is unambiguous is that work connected with the creation of such installations is under way, primarily there are preparations in the neighborhood of our most important universities, there are investments and developments of this type--let us call them innovation parks. For example, an organization is being formed in the neighborhood of the Budapest Technical University, which will operate partly as an experimental plant in areas of electronics, mechanical engineering and other areas, partly as an engineering undertaking, as a managerial office and to provide various services. But we cannot expect miracles from this. This could make university research work more effective even as connected with education. But this will not be a Silicon Valley, if that is what someone means by Industrial Park. They are dealing with similar ideas not only in the neighborhood of the Budapest Technical University but also in Szeged, Debrecen and other university spheres. Some of these, I think, will have state support.

[Question] Thank you. Now I have a question which got left out, about bonds.

[Answer] I jumped over the bond question after, as I recall, we were talking about capital flow within industry. I have no knowledge or information that any of our industrial enterprises are contemplating issuing bonds. Not in the industrial area, but in the area of services to the public, yes.

[Question] I asked this because in developed capitalist countries there is significant capital flow from other spheres into electronics, and this capital flow ensured the very dynamic development. For us?...

[Answer] Issuing bonds in Hungary has its peculiarities, partly peculiarities interdependent with political economics and partly peculiarities interdependent with the concrete conduct of it. I believe that this is not the most important solution for broad capital flow in Hungary today. All the more so because we have limits on growth, on the growth of the electronics industry, which far exceed the domestic ideas and possibilities. Such, for example, is the commodity quota system.

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## EAST EUROPE/MICROELECTRONICS

### IMPACT OF ELECTRONIFICATION ON HUNGARIAN ECONOMY OUTLINED

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[Article by Kalman Balotay, National Technical Development Committee (OMFB): "What Will the Future Bring in the Area of Electronification of the Economy?" The article is the debate initiating material presented by the author on 8 Jan 86 at a joint conference of the Electronic Computers and Control Equipment Department and the Process Control Department of the MATE (Measurement Technology and Automation Scientific Association). The first four paragraphs are the Hungarian language summary.]

[Text] Starting from a review of the world-wide development of electronics the article describes the brief history of the preparation of the domestic electronification program.

In describing the goals of the program the unique aspects of it--deviating from our programs thus far--are emphasized.

After describing the goals of the four interbranch subprograms the article describes the unique system of tools with the aid of which the program, primarily in the sphere of normative regulation, intends to realize the goals of the program by creating or increasing incentive.

The descriptive material concludes with a description of those responsible for the program and of the organizational solution for operational guidance.

In the past two decades the electronics industry has been the most swiftly developing branch throughout the world. By the mid-1970's it overtook, in production, the total production value of the auto industry and closely approached the total production of the petroleum extracting and processing branch. According to well known forecasts today this developmental dynamic will not change substantially up to the turn of the century.

The indicative data for the end of 1985 seem to justify a swifter developmental pace for the electronics industry in domestic development also; this is well illustrated by an index exceeding the total machine industry index by about 3-3.5 percentage points, representing a trend about 30 percent higher than the average.

On the world market the crucial proportion of electronics production is concentrated on the United States, the Far East (primarily Japan) and Western Europe. The share of the socialist countries in world production has not increased even with a relatively swift paced production development dynamic.

A similar process has taken place in the utilization of electronics, as a result of which annual electronics use per capita in the United States and Japan has exceeded \$500 Western European use moves around 40-50 percent of this, and the average for the other regions of the world can be put at \$30-35 (In Hungary this index approaches \$60.)

The significance of these statistics increases greatly if we accept the results of those studies according to which there is a very close connection between the quantity of electronic products used in the several countries and the ability of the economies to produce national income!

Another noteworthy item pertaining to automation from the statistics on developmental trends is that in Western Europe in 1984 the volume of automation per physical worker was about three times the sum turned to automation of white collar work. According to experts one of the important characteristics of coming years will be the swift approach of these two values to one another.

But all these are only random thoughts, results appearing on the surface, torn from that irresistible, world-wide process represented by the broad spread of electronic tools and the methods based on them. Electronics is capable of satisfying ever more of the social and economic needs at a level higher than the traditional one and its appearance is having a significant effect on the development of economies. This process is changing the value relationships in the sphere of both material and non-material production and services. The less developed countries must necessarily adjust to this process, largely disadvantageous for them, if they do not want to lose their competitiveness in economic and social terms. So in these countries--and here also--the need for electronification is increasing.

The development of a domestic economic development program started on the basis of comprehensive analyses deriving from a recognition of the necessities. Resolutions of the State Plan Committee represented definitive milestones in the work laying the foundations for the program:

- the approval of the conception for the program in November 1984;
- ratification of the first version of the program in May 1985; and
- agreement in October 1985 to submit the program to the Council of Ministers.

In December 1985 the Council of Ministers debated and adopted the comprehensive program, "The Central Economic Development Program for the Spread of the Social and Economic Use of Electronics," briefly the EGP, which the National Assembly approved as part of the law pertaining to our Seventh 5-Year Plan.

The goal of the central economic development and organizational program is to accelerate the process of the electronification of the economy in the interest of contributing to the following to the largest possible degree:

- an acceleration of technical progress and the development of the economy,
- increasing the productive capacity and export capability of the enterprises,
- reducing production costs,
- rational materials and energy management,
- improving the quality of products, services and the performance of work,
- improving the efficiency of work culture, organization and guidance,
- development of the public and production infrastructure, and
- ensuring the social conditions for the development of electronics.

The program embraces state measures for the social-economic spread of electronics and tasks for economic guidance. Within the framework of state organizational work it is intended to encourage the use of electronics and produce the conditions for this in the state sphere of authority.

In the conception for the program and in the final version approved:

--areas of emphasis were designated, areas in which the state will support the process of electronification with direct means fixed in the national economic plans;

--normative regulatory elements were defined, elements called on to orient enterprise behavior connected with economical electronification; and

--state organizational measures were worked out, measures called on to serve coordination of the various areas of electronification, provide the conditions for international cooperation and to set conditions for necessary intervention.

The basic unique feature of the EGP is that in its principles and methods of work it starts from decisions concerning a further development of the economic guidance system and is in complete harmony with these. So in its character it differs fundamentally from the central development programs of earlier plan periods and from the other planned economic development programs of our present 5-year plan, from our social-economic programs and from our action programs.

We might stress two defining elements of this difference:

--it is not investment centric, and

--it is not oriented toward the development of one or a few producing or infrastructural projects but rather deals in a complex way, from the side of state guidance, with the technical-social-economic interdependencies of research, education, technical development, production, services and especially applications.



In accordance with this the planning of the program, organization of its implementation and the system for monitoring and control are all unique, but require and use solutions in harmony with our guidance system.

The EGP is intended to orient the activity of the managing organizations in the area of use of electronics primarily with the general and to a smaller extent unique tools of economic regulation and technical coordination, is intended to affect ever broader strata of our society and have an increasing effect on changes in manpower structure and the development of social life. Summing up all this we can say that, using state measures, the electronification program will:

- contribute to the development of social receptivity,
- care for the development of the infrastructures basically determining electronification,
- contribute to satisfying the needs that arise or create conditions for satisfying service and know-how needs,
- care for the necessary degree of coordination of measures, and
- influence the economic environment system aiding the spread of electronification.

Areas of emphasis falling in the sphere of central authority have been designated in harmony with the conception of the EGP; the program will support the development of these with direct material assets in the form of interbranch subprograms.

In what follows we will give an outline overview of these.

#### 1. Interbranch Subprogram for Tasks of Telecommunications Development

Our country today, with 13.9 telephones per 100 inhabitants, is in the last place in Europe in terms of telephone density. As an illustration of this we should note that on the basis of international experience a value of about 20 per 100 is needed to begin successful introduction of modern information technologies. The existing telephone network is overloaded and a significant number of the exchanges need immediate replacement.

The telex network and the number of data stations are extraordinarily unfavorable also.

The subprogram was prepared in two versions for development of both the telephone and the telex and data transmission services.

The higher version which can be realized financially and physically is necessary for realization of the EGP, but the resources will be available only in the event of higher performance by the economy, so a lower version was also prepared, as a minimal, safer variant with the numerical data for the associated developmental achievements.

#### 2. Conceptional Tasks for the Educational, Training and Retraining Development of Electronification and Conditions for Their Realization

The subprogram is the chief tool for creating broad receptivity for the social spread of electronics. The goal is to gradually prepare participants at every level of education for the future tasks of the society and economy.

Although the subprogram deals primarily with the tasks of institutional education it also takes into consideration the tasks of study course training, further training and retraining, with special regard to the effect of electronification on transforming the structure of the work force. The social spread of electronification will create mass-scale awareness-forming tasks and the subprogram sets forth the organizational tasks aimed at solving them.

### 3. Tasks and Conditions for the Development of the Use of Informatics and Computer Technology in State Administration

In the center of the subprogram stand the coordinated further development of the information systems of central state administrative organs, the further development of the large central databases (basic records and systems for functional guidance), the renewal of the outmoded computer park and, where justified, creating conditions for the network operation of computers.

The subprogram gives preference to developments serving the socialization and broad utilization of electronics, as applications trends. These are:

- organizational and informatics solutions improving the efficiency of state administrative work and its service capabilities,
- making records systems complete and developing services based on them, and
- developments improving interbranch cooperation.

Through central coordination measures the subprogram intends to solve:

- broad and rational utilization of information property,
- informatics training of state administrative leaders and workers,
- improving the infrastructural conditions for informatics services,
- providing professional information, and
- management of international informatics and data traffic work.

The common aspect of the two versions of the subprogram worked out is the starting point, that it has become necessary to eliminate in 1986-87 at least in part the shortfalls caused by the rescheduling which became necessary due to the restricted resources of the preceding plan period.

### 4. Technical Development and Research Tasks of Electronification

According to data from developed industrial countries an increasing proportion of the social level expenditures turned to research and technical development are used in the various processes of electronification, the preponderant part of state supports goes to this area and the leading electronics firms of the world are turning 8-13 percent of their sales receipts to research and technical development. It is characteristic for investment costs at these enterprises, in general, to be of the same order of magnitude as costs turned to R and D, in the interest of following the swift technological change.

Recently, governments also have initiated R and D integration processes which, thanks to great concentration, accelerate the realization of developments. In

our country treating the electronification process as a priority was realized in part in the period of the Sixth 5-Year Plan already, in the realization of both domestic and CEMA tasks.

In the present plan period, in addition to the domestic developmental emphases necessary for realization of the goals formulated in the EGP, additional international tasks have appeared also, first of all the complex program for the scientific-technical cooperation of the CEMA countries up to the year 2000, the electronification and complex automation chapters of which are based directly on the electronification process.

Among the stressed R and D plans approved for the plan period the following are linked most directly to the EGP:

- the G-1 program, constituting an interbranch subprogram of the EGP, involving computer technology, communications and automation R and D tasks of electronification;

- the G-5 R and D program for manufacture of electronic parts and subassemblies;

- R and D tasks for manufacturing automation and precision engineering related to electronification (G-6);

- the subprogram dealing with new electronic planning systems defined within the framework of the G-2 subprogram for economical use of materials, development of technologies and utilization of wastes.

A number of ministry level programs linked to the above central, stressed programs will also aid the spread of electronification.

#### 5. Branch Electronification and Informatics Subprograms

From the formal and organizational viewpoint the branch subconceptions and programs of the 18 ministries and organs with national authority worked out on the basis of the resolution of the State Plan Committee do not constitute a part of the EGP, but indispensable supplementary tasks and sources for the really comprehensive spread of electronification at the scale of the national economy are formulated in these subprograms. They have defined:

- goals for the development of the ministry level information systems of the branch,
- the more important developments of the electronic infrastructure,
- the electronification processes necessary for better conduct of the organizational, management and guidance tasks of the branch,
- the chief areas for enterprise and institutional electronification,
- tasks and action programs of the ministries,
- the needs of the ministries from interbranch programs, and
- the order of magnitude and composition of the assets and resource needs of the branch.

In the course of working these out and harmonizing them a number of attitudinal problems had to be solved, and ensuring the resources needed for realization was not solved for some of the programs.

The electronification program and the system of programs aiding its realization, as outlined above, are to be implemented with a unique assortment of tools and methods. In what follows we will outline the chief characteristics of this system of tools.

Reducing duties on electronic parts, on primary materials and technological equipment needed to manufacture them and on electronic products which cannot be purchased directly because of restrictions:

Execution can be expected to go into effect from the middle of 1986 in coordination with modification of the obligations and duties system deriving from the GATT membership of the country.

Reducing the price of electronic products of domestic and socialist manufacture:

In some cases and in general the prices of products in both categories significantly exceed the world market price level, which constitutes a serious obstacle to distribution. Watching the price level of domestic products and bringing it closer to world market values has become the constant task of the National Materials and Price Office, while a significant sum of state price supports will be available in 1986-87 within the framework of a measure approved to modify the high price level of socialist, especially Soviet, import.

In the interest of encouraging software trade a state decision has been made to eliminate the consumers turnover tax on software and measures are being implemented to favorably modify the financing of software and the method of keeping it in stock.

A number of measures are being taken to support the adopting of new electronics technologies. An accumulation tax concession pertaining to a definite sphere of investments supporting the goals of the EGP, a specified expansion of the types of tools which can be purchased from the MUFA [technical development fund], making possible the delayed activation of technological developments and putting accelerated write-off in a defined sphere into the enterprise decision making sphere are all regulations intended to increase receptivity and the spread of electronics.

In the area of foreign trade procedures, providing an accelerated authorization procedure in connection with the EGP and adjusted to the possibilities of the balance situation is a supportive measure while at the same time the program fixes the necessity of conversion pertaining to the shipping in of unjustified capitalist import computers.

In addition to a few other measures pertaining to organizations operating in a specific management environment the program has called attention to a few further possibilities in the area of a long-range regulatory development of

economic guidance, possibilities which may be realized in the second half of the plan period.

In the area of credit policy the program did not make a recommendation for the development of special credit quotas or rates of interest, but it did recommend the development of a general testing system for the modernness of credit requests, primarily in the interest of a rational priority for electronic solutions. A change in attitude is necessary in this regard, because computerized information systems, automated design systems and systems for office automation contribute greatly to increasing the efficiency of enterprise activity and should not be regarded as unproductive investments when judging credit requests.

Last but not least, among the methods of the program a role is played by the possibility of a World Bank credit arrangement; making this concrete will be one of the significant organizational tasks of 1986.

Among the organizational tasks of the EGP, projecting the social effects of a spread of electronics at the level of the national economy with an analysis of a few changes in the manpower market which may be felt even in the short term, it defined basic tasks of accomodating to the changing situation. In this area there is a need for developing a new employment policy planning method which is not yet well founded enough.

Two other ideas must be mentioned to make an introduction to the EGP complete. One is the development of a new state statistical system linked to the EGP. It should make possible, better than the one today, a tracking of the realization and progress of the EGP. The new monitoring system should be introduced in 1986 as a result of the joint work of the leadership of the KSH [Central Statistics Office] and the EGP.

The other is the guidance and control system of the program which, because of the unique character of the EGP, required a planning, guidance and approval mechanism differing from traditional central development programs, as a final result of which there was a Council of Ministers resolution based on positions taken by the State Plan Committee and the Economic Committee.

Responsibility for execution also shows unique aspects, for the chairman of the National Technical Development Committee guides execution of the EGP. To support realization he has created the Electronification Economic Development Committee (EGB), the G-1 research and development program office (the EKP Office) supporting the program and an EGP Secretariat.

Those responsible for execution of the interbranch subprograms are, in order:

- the chairman of the Hungarian Post Office,
- the Minister of Cultural Affairs, and
- the chairman of the KSH.

The purpose of this outline description was to provide a general overview of the most significant and powerful economic development program of the Seventh 5-Year Plan, with which we wanted to speak to the broad domestic spread of electronics.

#### Biographic Note

Kalman Balotay went to the Budapest Technical University after graduating from the Machine Industry Technikum. He completed his studies in the electric machine branch of the heavy current section of the electrical engineering school in 1960 as a People's Republic Scholar with an honors degree.

Between 1960 and 1965 he received significant tasks in setting up and putting into operation the high voltage laboratory of the VEIKI [Electric Power Industry Research Institute]. Between 1965 and 1969 he directed development-manufacture-installation work on power plant digital data collection equipment as deputy and then independent chief of the automation department of the VEIKI. His area of independent research work was research on and design of a stepping motor.

Between 1969 and 1979 he was chief of computer development projects at Vilati. Then for 3 years he was technical deputy director of the enterprise.

Since 1982 he has been a deputy main department chief in the Automation and Computer Technology Secretariat of the OMFB dealing primarily with questions of automation research and development.

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R AND D TASKS OF HUNGARIAN ELECTRONIFICATION PROGRAM

Budapest MERES ES AUTOMATIKA in Hungarian No 9, 1986 pp 339-342

[Article by Mrs Ivan Ielkes, National Technical Development Committee (OMFB): "Computer Technology, Communications and Automation Research and Development Tasks of Electronification (The G-1 Program of the National Medium-Range Research and Development Plan)." The first paragraph is the Hungarian language summary. The manuscript was received 26 Jun 86.]

[Text] The article introduces with a few thoughts the importance of electronification, which is already well known today. In the Seventh 5-Year Plan also the electronification of the national economy is supported by the programs of the National Medium-Range Research and Development Plan. This program contains the computer technology, communications and automation research and development tasks of comprehensive significance. The article describes the antecedents, goals, structure and content of the program and the guidance system for the program.

A vigorous increase in the efficiency of our economy is the only way by which we can solve our present problems and ensure our social-economic development. One tool and an indispensable condition for this is for us to link into the chief currents of scientific-technical progress taking place in the world and to make use ever more quickly of the achievements of research and development in production and in other spheres of society and the economy.

This goal is served by the National Medium-Range Research and Development Plan (OKKFT), which constitutes a part of the Seventh 5-Year Plan. The program of this plan which is discussed below contains the most important computer technology, communications and automation research and development tasks of electronification, tasks of comprehensive significance.

Electronification is a world trend. Today this is obvious not only to technicians but also to anyone who looks at the world with open eyes, who meets with modern products ever more frequently in everyday life.

At the same time the growing role of peak technologies, the penetration of electronic solutions into the design of industrial products and manufacturing technology, the spread of electronics and computer technology in regulating and controlling various production processes, its becoming increasingly the

only tool in processing and transmitting information and its spread in education, medicine and guidance put gigantic tasks on researchers, developers, manufacturers and users.

We will be able to maintain our place in the competition taking place in the world only with a rational uniting of the forces in the country and with a maximal recognition and exploitation of the possibilities given by international cooperation. (And this does not apply only to us; the socialist countries and various groups of the countries of the capitalist world have worked out great international development programs.)

The program contains a possibility for meeting both conditions--a united furtherance of national electronification and international cooperation:

- in the Seventh 5-Year Plan the research and development program constitutes an organic part of the central economic development and organization program started in the interest of the spread of social-economic use of electronics,

- its chief goals in general and some of its themes concretely are linked to the Complex Program of the CEMA countries for scientific-technical progress up to the year 2000,

- to realize its goals it plans international cooperation, adoption and further development in every area where we can achieve by this means a faster and better result than by domestic development, and

- it demands and organizes close contacts within the framework of the OKKFT or with other research and development programs organized by the ministries.

#### Goal, Conception and Antecedents of the Program

The program proposes the realization of a number of goals, interdependent with one another but necessary in themselves, each of which presumes the cooperation of researchers, developers, manufacturers and users.

- An important task of it is to perform the stressed research and development work necessary to accelerate the social-economic spread of electronics.

- It must contribute to the development of the electronics industry by the development or adoption of the tools and equipment, at a developed technical level, necessary for this. The market capability of the electronics industry and of Hungarian industry as a whole requires this.

- By studying the social effects of electronics and supporting certain educational tasks it contributes to discovering and forming the role of human factors.

In the interest of these goals the work must be done at a level which prevents an increase in the lag and makes it possible to catch up in several areas.

Handling the computer technology, communications and automation research and development tasks of electronification in one OKKFT program reflects a new attitude compared to former ones. We did not find such a systems principle,



complex approach in the national research and development programs cultivated in the Sixth 5-Year Plan nor in the work organized by the various ministries.

The complex approach is made necessary by the close interdependence of the areas making up the subject for research and development, by their character of supplementing and presuming one another.

The program has significant antecedents. The foundations for our present goals were laid by a number of programs of the National Long-Range Scientific Research Plan (OTTKT) in the fifth and sixth 5-year plans and of the National Medium-Range Research and Development Plan (OKKFT) in the Sixth 5-Year Plan.

These included primarily:

- the Research Target Program of the Central Computer Technology Development Program,
- the research and development program for communications tools and systems,
- the R and D program for use of computer technology, and
- the research and development program for microelectronic parts and for the materials and technologies needed for their production;

and among the ministry programs:

- microcomputers and their applications systems (OMFB),
- automation tools and systems (Ministry of Industry), and
- research applications of computer technology (Hungarian Academy of Sciences).

In addition to the above the compilation of our program was made possible and necessary by a number of domestic research and development programs and by work taking place within the framework of international--multilateral and bilateral--technical-scientific cooperation agreements.

The evaluation of the results of the above mentioned projects has in part taken place and is in part under way. Well founded, highly significant themes are continuing in the program discussed here or within the framework of other programs or as individual tasks; others must be regarded as completed, their results being put into production and marketed as soon as possible. There are also trends into which more money should not be put.

It is our general experience, also valid for the Seventh 5-Year Plan, that the R and D tasks which can and must be supported from central sources are those where:

- one can find a common interest of the researcher-developer and the user,
- significant results can be expected in changing the structure of production or in increasing efficiency, or
- the foundations for our future development can be laid in this way.

It is very important in this swiftly developing technical area that the assets needed for productive investments be available in time for the swift

introduction of developmental achievements, for otherwise the research and development work expended is lost.

#### Structure and Content of the Program

The program consists of four subprograms interdependent with and supplementing one another (to differing degrees):

- prospective computer technology and automation tools and systems,
- communications systems,
- applications of computer technology, automation and telecommunications systems, and
- the research necessary to lay the foundations for the broad spread of electronification.

Briefly, the content of the several subprograms is as follows.

#### I. Research and Development on Prospective Computer Technology and Automation Tools and Systems

Within the framework of the subprogram the goal is the development of modern hardware and software tools and systems and of the environment necessary for their development. Among the chief theme groups of the research and development work are:

- Development of supermini computers and special processors in the interest of maintaining the results achieved thus far and the positions we have won. It is necessary to increase performance and the reliability parameters, to use the standards accepted throughout the world, to be able to build in a modular way and to be able to build various network systems. Special attention must be turned to engineering applications and to production guidance systems based on large databases;
- Development of very powerful professional personal computers pointing in the direction of a new generation;
- Creation of prospective computer peripherals which, in addition to supplementing domestic computers and being used in systems, can constitute an independent, "hard" commodity base. These include, for example, optical background stores, letter quality printers, laser-xerographic printers, page readers, etc.;
- Among prospective tools and systems for automation the program contains primarily the solution of R and D tasks needed to automate technological processes. The goal is development of intelligent automatic elements, sensors and intervention blocks which can be fitted into modern automation systems, following trends of international standardization, of distributed intelligence systems based on local networks which can be built out of these and development of environment tolerant process control devices and systems;
- Computer network devices and systems suitable for distributed processing, ensuring the cooperation of computer centers and computers of different power based on public data network services;

--The subprogram deals with the tasks of software development needed for the devices and systems to be developed and turns significant attention to the development of modern methods and tools--not provided from other sources--for software preparation;

--This subprogram also deals with the development of system elements and tools needed for telematic services ripe for domestic introduction (Teledata, Teletex, Faximile) and the development of some tools for image processing.

## II. Communications Systems

The goal of the subprogram is to see to the research and development tasks judged of first order importance which are necessary to lay the foundations for the development of telecommunications and for a competitive product structure for the communications engineering industry.

A system of devices of great value operates in communications. For this reason research and development must ensure compatibility with existing equipment in user parameters, while in the interest of economical production and operation they must follow radically new design and realization principles.

The subprogram strives for a further development of communications elements which will make possible supply to more and new communications services at the same time. (For example, use of the broadcast network for information transmission, creation of local systems compatible with the public network, development of multipurpose cable TV systems, etc.)

The subprogram embraces the most essential theme groups needed to reach the above goals.

- It deals with design, development and operation of networks,
- with systems technology research and development tasks,
- with systems and equipment development tasks to be performed as a result of the spread of digital techniques and microelectronics in the area of switching technology,
- with the development of transmission technology systems and equipment (wired and wireless), including devices for optical links; and
- the subprogram also deals with the development of certain consumer items and last but not least turns great attention to research preparing for integrated information transmission (ISDN) which represents the future developmental path for telecommunications.

## III. Use of Computer Technology, Automation and Telecommunications Systems

In part this subprogram will help electronification with systems put together on the basis of tools and developmental methods worked out within the framework of the Sixth 5-Year Plan and in part it will exploit the results to be attained within the framework of subprograms I and II for prospective applications systems. (We can count on these, naturally, beginning in the second half of the plan period so their broad spread can be expected only in the next plan period.)

The chief theme groups are computer technology model systems which can be linked together and are suitable for mass use (on the basis of a competition),

and the development of complex, combined enterprise, inter-enterprise, branch and national applications systems.

Here the program posts as a goal primarily the solution of tasks which are of great importance from the viewpoint of the national economy, such as the development of information or control systems which can be used in the areas of electric power, transportation and freight and the petroleum and gas industry, development of methods aimed at modernizing the flow of money, realizing modern methods for various types of inventory information and creating production control solutions of great significance.

The subprogram deals with various expert applications systems, use of automated engineering design within this sphere of the program, model systems for use of telecommunications (networks, telematics) and prospective applications of automation devices and systems.

#### IV. Basic Research Necessary for the Broad Spread of Electronification

In this subprogram we have gathered together primarily the most essential basic research themes which will prepare for developments and projects which will be part of electronification primarily in the next plan period.

This includes the research necessary for the development of fifth generation computer equipment and systems (knowledge processing, artificial intelligence) and tasks laying the foundations for the long-range development of communications (optical communications and technologies, achieving very high operating speeds).

The subprogram deals with new principles of programming theory, of machine speech processing and of natural language communication.

This subprogram includes research on the social conditions for and effects of electronics.

Certain tasks interdependent with the development of informatics education also figure in this subprogram.

The program places suitable emphasis on standardization tasks and on methods for taking over and testing the results.

#### Organization and Guidance System for the Program, First Experiences

The "program responsible officer" is the senior general director of the program.

His basic task is to make the fundamental decisions affecting the goals of the program, execution of the more significant tasks, its results and its economic conditions.

Janos Sebestyen, general deputy chairman of the OMFB, is the responsible officer for the G-1 Program.

The "program commissioner" provides operational guidance of the program. (This is Iaszlo Pal, chief of a main group at the OMFB.)

The bodies for the program are the program council and the technical council.

The task of the program council is to aid the responsible officer in strategic questions, prepare decisions and make recommendations. Its chairman is the responsible officer. Its members are:

- representatives at the deputy minister (deputy chairman) level of the chief authorities most interested in implementation of the program or using its results,

- the leaders at the director general (director) level of the enterprises taking the greatest role in financing the program with enterprise assets,

- the program commissioner, the president of the technical council and the chief of the program office.

The task of the technical council is to provide a technical foundation for the positions taken by the program council, to provide technical support for the work of the program commissioner, and to play a significant role in defining the tasks and judging the results. Its president is Academician Tibor Vamos.

Its members are experts recognized in the field who play a significant role in implementing the program and using the results.

A program office, operating within the framework of the OMFB as an independent organizational unit, takes care of operational activities connected with coordinating and organizing the program and takes care of secretarial tasks for the two councils.

The technical council and the program council discuss the annual thematic and financial plans of the program and they are approved by the chairman of the OMFB taking into consideration the recommendation of the responsible officer. We already followed this procedure with the 1986 plan.

The program office, with the authorization of the responsible officer, signs contracts to finance realization of the several themes from central sources. The Invest-Bank handles the financial side of the contracts.

We organize realization of the tasks with various methods. We announce open or by invitation competitions for some of the themes. So far we have announced four competitions:

- computer technology systems which can be used very widely,
- industrial expert systems,
- letter quality printing equipment, and
- optical page reader equipment.

The competitions have been evaluated and we are in the process of signing contracts.

We have initiated the creation of special associations for themes which logically belong together and require close professional coordination and joint work. So far, even before formal creation of the special association, joint work on some parts of the tasks has begun on this basis in the theme groups for automation systems and network computer devices.

In some theme groups base institutions or "prime contractors" will do the R and D work on the basis of contracts signed with the program office. These patrons will bring in the additional cooperating organizations needed.

We sign contracts directly for R and D tasks belonging unambiguously to one institution.

University faculties, Academy research institutes, research institutes operating in the enterprise form, development and producing enterprises and cooperatives participate in realization of the program.

Thematically the tasks planned to get started in 1986 embrace about 60-65 percent of the program. The 1986 financial plan counts on using about 14-16 percent of the central MUFA [technical development fund] prescription for the 5 years.

The fact that the subprograms depend on and supplement one another, the link to other programs--primarily the program for the electronification of the national economy and the complex program of the CEMA countries--and the swift development of the professional area all require the openness of the program. We must make possible a selection of themes according to need and the taking up of new ones. At the same time we must guarantee sufficient security for research and development already begun and progressing successfully. Work committees created according to a method of work adopted by the technical council for the program will prepare proposals for the preparation of concrete contracts and competitions, to evaluate the progress of R and D work and to check the results.

#### Biographic Note

Mrs Ivan Lelkes graduated from the Budapest Technical University in 1956. Her first job was at Transzvill where she worked as a technician, as a plant engineer and then as a development engineer.

She was a scientific colleague at the Electric Industry Research Institute and then again a development engineer at Kontakta and, after the enterprise amalgamation, at Medicor. Later she was chief of the technological coordination department there.

From 1964 to 1970 she was a political worker for the MSZMP Central Committee. After 1970 she was deputy chief of the technical main department and then of the industrial development main department at the Ministry of Metallurgy and the Machine Industry. From 1981 to 1985 she was leader and then chief counsel for the Electronics Experts Group in the Ministry of Industry.

At present she is chief of the Electronification Research and Development Program Office created at the OMFB to organize and coordinate the G-1 program of the OKKFT [National Medium-Range Research and Development Plan] titled "Electronification Computer Technology... etc."

CAD COMES TO GANZ-MAVAG VIA MICROVAX II COMPUTERS

Budapest UJ IMPULZUS in Hungarian No 2, 24 Jan 87 pp 12-13

[Article by Peter Sz. Szalay: "Smart Software for Designers; MAVAG Uses the Vax"]

[Text] A product which is competitive on the world market originates not primarily in manufacture but rather in the phases preceding it. The roles of development, preparing a bid and designing are great, for whether or not the customer will even need the final product of the future depends on these. Ganz-MAVAG, one of the largest machine industry enterprises doing custom manufacture, lagged behind the world leaders in just these preparatory jobs--so much so that its survival was endangered.

The structural transformation of the enterprise has taken place, if late. They created independent factories, and began the development of a modern manufacturing base in them. One of the most important links in the reconstruction, in maintaining or increasing competitiveness, was computer support for the phases preceding manufacture, including the introduction of a computer aided design system, the first phase of CAD/CAM (computer aided design and manufacture) methods.

"To what extent will such a designing system increase the competitiveness of the enterprise? Can it take the place of engineering expertise and imagination?"

"It does not replace engineering creativity. Although that wouldn't be bad, because many good experts left the enterprise in the hard times. It will make the work of engineers faster and more efficient," said Dr Istvan Gulyas, technical deputy director of the enterprise. "The Railroad Vehicle Factory, which produces primarily for export, can get orders only if it can make properly prepared bids at the competitive discussions. Preparation of a bid meeting the unique conditions of competitions with ever shorter time limits can hardly be imagined today without computerized aid, and our competitors have these tools. But the system also offers real aid with an order in hand. It facilitates for the designer the selection of the most suitable elements, it does the necessary calculations, it makes modern materials planning possible and this reduces costs and increases economicalness and efficiency. According to experience, after acquiring suitable practice, this latter

increases by 20 percent in the case of entirely new designs, by 40 percent in the case of redesigning and by 90 percent in the case of making corrections. For us 60-70 percent of the designing work is redesigning and correction of drawings, so introduction of this system will bring real results, after loading the drawings databases. The system being developed will be the first CAD model system of the country which can be used in custom manufacture (an earlier version of it is already in operation at the Ikarusz). In the first stage we will use it only at the Railroad Vehicle Factory and Machine Factory; later we will introduce it in the other factories as well."

"It appears from what you say that the CAD system should have been purchased earlier. Does the enterprise, which has become fund deficient, now have the money for it?"

"The system installed at Ganz-MAVAG is among the most modern; it is very difficult for an enterprise in a socialist country to get systems like this. So acquisition did not depend on our intentions alone. In fact, we had neither the necessary foreign exchange or even the forint cover for it. The equipment and the software were purchased by the Hungarian Foreign Trade Bank, and we lease it from them."

"What can the CAD system do, and in what stage is its installation?"

"The MikroVAX II," replied Mihaly Osztatni, chief of the CAD office, "is a product of the American DEC (Digital Equipment Corporation), an extraordinarily powerful microcomputer. Its peripherals include one--the picture tube of the graphics monitor--which can be made now only in America. The background memory of the computer--a hard disk Winchester--has a capacity of 1 gigabyte, its operational memory is 9 megabytes. We also got special high write density tape for it, with a capacity of 6,250 bits per inch."

"We got three computers; one operates in the Railroad Vehicle Factory, another in the Machine Factory and a third in the computer center. At present 14 terminals are connected--five graphic and nine alphanumeric. There are two graphic displays and one plotter in each of the two factories. There is one graphic display in the computer center. We plan to install another five alphanumeric displays; these are being designed and assembled by our own experts. All the equipment will be put together into a uniform system; we are preparing the plan for this in cooperation with the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences]."

"The computers run under supervision of the VMS operating system," continued Gyorgy Belucz, developmental engineer. "The soul of the whole system is the designing software, also of American origin. This can be specialized for various branches of industry--including machine manufacture and vehicle manufacture--and general basic databases for these are already available in advance. Our task is to load our own databases, with drawings of our machine elements and structural units. When this is done the most varied operations can be carried out on the electronic plotter, on this very intelligent drawing board, such as optional moving, changing and insertion of drawing elements and inserting finished drawings into the drawing being worked on. The program



system is also suitable for manipulating three dimensional figures. Thus even complex spatial forms, such as vehicle body elements, become easily manageable. A three dimensional picture of the planned vehicle can be displayed on the graphic display and even printed out on the hardcopy unit.

"In addition to the drawing programs the designer has available various associated programs with the aid of which he can do the bulk of the calculations, with the computer, practically at the same time he is drawing. Then the technologist and those preparing manufacture can do their work connected with the design immediately on the finished drawing.

"The increased quality requirements being made of products today make it necessary for the designer to be able to measure the mechanical, thermal, etc. characteristics of the structure before manufacture of a prototype or sample unit. This program system makes possible use of the finite element method, with which the designer, in an early phase of the development process, can model mathematically the design to be created and with calculations done on the model he can verify his decisions, and so realize the most appropriate and most economical design. So the graphics software is capable of a great deal, and according to the contract we will get the results of development for another 2 years. The next step of the development--of course this will take several years--will be creation of conditions for a CAM system, and then introduction of such a system. The conditions for computer controlled manufacture do not yet exist--that is for the same computer which participated in the designing process and development of the technology to also control the processing units. The MikroVAX computers and the factory production lines are not yet linked together. At present we program the processing machines with punch tape. Perhaps it would be easier first to have the central computer control the tape punching equipment. Even this would be a big step toward introduction of a CAM system."

"How long will it be before the CAD system actually participates in enterprise designing work?"

"We will be able to design parts within about 6 months," promised Gabor Jex, chief of the organization main department, "and loading the most necessary part of the database will take one year. During this time, naturally, we will train those engineers, designers and technologists whose useful colleague this equipment will be. Obviously quite a few will easily get acquainted with it and will soon master its operation, but there will be those for whom this will take longer and even those who will not be able to overcome their antipathy for the computer. We went through this at the enterprise before when the personal computers appeared. Now, however, receptivity will surely be better for in recent years computer technology has become a part of designing work."

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